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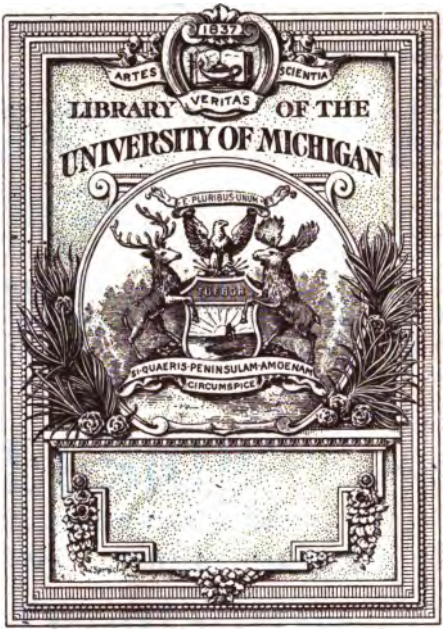

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MULTIPLE COST ACCOUNTS

BY

H. STANLEY GARRY,

CHARTERED ACCOUNTANT.

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EDITOR'S PREFACE.

THE object of the series of handbooks that is being published under heading of THE ACCOUNTANTS' LIBRARY is to provide, at a reasonable price, detailed information as to the most approved methods of keeping accounts in relation to all the leading classes of industry whose books call for more or less specialised treatment. No such series has hitherto been attempted; but there exist, of course, numerous separate works dealing with the accounts of one particular class of undertaking. These separate works are, however, for the most part either too expensive, or too superficial to answer the purpose that is particularly aimed at by THE ACCOUNTANTS' LIBRARY, which is intended to supply the student with that specialised information which he may require, while at the same time affording to the trader, banker, or manufacturer who is not in a position to secure the fullest information for his purpose, knowledge which can hardly fail to be of the very greatest assistance to him in the correct keeping of his accounts, upon a system specially adapted to his requirements, and therefore involving a minimum expenditure of labour. It is expected that the series will also be found of material assistance to bookkeepers of all classes.

175172

Without aiming at giving an exhaustive account of the manner in which each separate business is conducted, the technical points in connection with each industry will receive as much attention as is necessary in order fully to elucidate the system of accounts advocated, while each volume will be the work of one who has made that particular class of accounts more or less a speciality. It is obvious, however, that to enable the necessary ground to be covered in the space available, it is incumbent to assume upon the part of the reader a certain knowledge of general bookkeeping. The extent of the knowledge assumed will vary according to the nature of the class of accounts considered. For example, in the volumes on "Bank Accounts" and "Shipping Accounts," a thorough acquaintance with ordinary double-entry bookkeeping is not unnaturally assumed; but in the case, for instance, of "Auctioneers' Accounts," "Domestic Tradesmen's Accounts," and other similar volumes, such explanations are included as will enable the ordinarily intelligent reader fully to grasp the methods described, even although his knowledge of bookkeeping may be of an elementary description. These explanations are, doubtless, superfluous as far as accountants are concerned, but are necessary to make the volumes of value to the majority of those specially engaged in these particular industries.

To subscribers for the whole series it may be added that, when completed, it will form a most valuable and practically complete library, dealing, at the hands of specialists, with practically every class of accounts, and illustrating the application

of the theory of double-entry as described in general works on bookkeeping.

The first series (of twenty volumes) has already been completed, and particulars of the subjects dealt with will be found on p. i. A second series (which will comprise about thirty more volumes) is now in progress, which when issued will complete the scheme. Many of these have already been arranged for, but the Editor will be glad to receive suggestions and offers from accountants of experience for the undertaking of volumes not yet announced.

34 Moorgate Street,
London, E.C.
June 1903.

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INTRODUCTORY NOTE.

THE organisation of a system of Cost Accounts in any established business depends mainly for its success on the relation of its methods to the lines on which the business has been developed.

A survey of the problems met with in various classes of business shows that lines of organisation, rather than similarity of products, provide the clearest basis for a system of Cost Accounts.

It follows, therefore, that we may classify all industries, or undertakings, in groups, according to their lines of organisation. By this means we are able to treat separately with the special problems and requirements of each group, and to indicate the methods which are specially applicable to any particular organisation of business.

The grouping adopted in this series will be as follows :—

Multiple Costs.—Applicable to undertakings where a number of products are involved bearing little or no apparent relation to each other in cost or selling price—such as Engineering Specialties, Cycles, Hosiery, Boots, Furniture, Agricultural Implements—in which standardisation in parts is carried to a high degree of specialisation in manufacturing.

Terminal Costs.—Applicable to undertakings where definite contracts are entered into, in which the costing is definite and terminating—such as Engineers, Shipbuilders, Builders, and the like.

Single Costs.—Applicable to Breweries, Collieries, Quarries, Mines, and businesses in which there is a natural unit of cost, as the barrel, the ton raised, &c. &c.

Process Costs.—Applicable to Chemical Industries, Food Products, &c., in which conversion of material takes place, and there are principal and by-products, such as Tanners, Fellmongers.

Operating Costs.—As Railways, Tramways, Gas and Water Undertakings, Electricity, and similar industries.

It is to be noted, however, that there are instances of businesses which, from the special nature of their organisation, except themselves from their own group. The character of their production, and the degree of specialisation attained in the method of manufacture, constitute the only effective basis of decision as to which group they should be classified under.

The present volume deals with the first of these groups, and other volumes are in course of preparation dealing with the remaining four.

MULTIPLE COST ACCOUNTS.

CHAPTER I.

"MULTIPLE COSTS ON THE UNIT SYSTEM."

"A SYSTEM of costing applicable to undertakings where a number of products are involved, bearing little or no relation to one another in cost or selling price, and in which the manufacture is organised on a high degree of specialisation in parts."

Illustration.

Engineering Specialties.

Cycles.

Furniture (Manufacturing).

Agricultural Implements, &c. &c.

The difficulties to be overcome in the application of systems of Cost Accounts to these industries may be summarised as follows:—

(1) Clerical labour involved in following the details of the manufacture.

(2) Seasonal demand, involving preparation periods in factory output.

(3) Absence of relation of cost or selling values between products.

(4) Fluctuation in *character* of output.

These difficulties may in some cases be modified by the adoption of Departmental Accounts where the factory organisation is such that the manufacturing departments are specialised to one or more classes of products, and the problems are, by this means, resolved into a series of departmental single costs.

This is, however, only possible to a very limited extent, and effective specialisation is generally organised on the lines of similarity in operating, rather than division into classes of products; thus avoiding duplication of machinery and plant. It is more economical and effective to aggregate machinery dealing with one class of operating, as regards power, tool cost, and labour cost.

Whether we take cycles, agricultural and other machines, or any other industry under this section, we find that, apart from the vital effect of fluctuations in the prices of raw material, the payment of labour, or the competition in sale prices, all of which are readily measurable in comparison by averages, we have a floating and fluctuating output to contend with, the variation in the character of which forms the major difficulty in costing, and the results of which are only measurable in the annual or periodical stocktaking. Moreover, it is due, in the most part, to this fluctuation in the character of the output that leakages occur in the profits of the factory. It is no uncommon thing for the annual stocktaking to disclose results which are totally at variance with the

managerial anticipations of the year's operations; and while it is comparatively easy to appreciate the effect of fluctuations in prices of raw material, in labour, or in selling prices, the effect of fluctuations in the character of output on profit and cost is a matter not readily grasped or understood.

In the case of Terminal Costs (see Introductory Note), the balance on contracts is a readily ascertainable measure of working profit or loss. In the case of Single Costs, the average price realised per barrel against the expenses per barrel, or the ton of coal raised, gives an easily appreciated comparison; but with the industries comprised in this section it may frequently be found that, with an output similar to that of other years in value, the results are disappointing in the profits earned.

A careful analysis of the manufacturing expenses may disclose variations which have affected results, but most probably to a minor degree only; and the leakage is generally assumed as due in some unexplained way to differences in cost, which, owing to the varied and considerable detail of products, it is impossible to trace.

In the adoption of a special system of costing to the requirements of the industries comprised under the heading of "Multiple Costs," the principal object to be accomplished is the realisation of some common standard of measurement of output, in order to admit of the comparison of manufacturing efficiency and of the allocation of oncost and expenses.

The system which is advocated in the following pages has been designated the "Unit System," and consists of the setting up of a standard unit of output, in which may be expressed all the factors of material, wages, and expenses, and into which all products are subjected to a conversion into terms of the standard.

Shortly, it is proposed by this method to obtain for the businesses mentioned the advantages which obtain in the case of Collieries, Mines, Breweries, &c., and the comparison of the factory output on a unit of efficiency, as in the ton of coal raised, the tonnage output of mines, and the barrelage of the brewery, and to do this with a minimum of clerical effort.

It is claimed that the Unit System of costing applied to the industries under this section can be developed to demonstrate the comparison periodically of the results achieved as expressed in the weekly earnings of the businesses; and, further, a comparison of the stock on hand, results of the Sale Department in profit, work in progress, and weekly wages, all measured in units of production. Further, these results can be obtained at a minimum of clerical labour, and with the provision of details which will enable the manufacturer to appreciate the results shown and to place his finger on the cause of any variation in earnings.

CHAPTER II.

BALANCE SHEET AND ACCOUNTS.

FOR the purpose of illustrating the working out of the "Unit System" of cost, the accounts of a firm of agricultural implement makers have been taken as a basis, and a full set of the last completed accounts is set out, showing Balance Sheet, Profit and Loss Account, Revenue Account, Trading Account, and Manufacturing Account.

THE EASTSHIRE AGRICULTURAL WAGON & IMPLEMENT COMPANY, LIMITED.

BALANCE SHEET at 31st December 1904.

Registered Capital: Preference Shares, 2,000 of £10 each. Ordinary Shares, 5,000 of £10 each Borrowing Powers, £15,000.

Capital and Liabilities.		£ s d	*Assets.*		£ s d
Issued Capital—			Land for Works		1,125 12 6
1,300 Preference Shares, fully paid	£13,000 0 0		Plant, Machinery, &c.	£10,000 0 0	
3,000 Ordinary Shares Do.	30,000 0 0		*Added* during year	.. 900 0 0	
		43,000 0 0		10,900 0 0	
Trade Creditors and accrued charges		2,133 12 6			
Sundry Reserves for Plant Renewals, &c. &c.		3,236 11 4	Depreciation at 5 per cent. ..	.. 500 0 0	
Profit and Loss Account—					10,400 0 0
Undivided Profits brought forward ..	2,324 1 8		Stock-in-Trade at or under cost		9,464 16 4
Balance of Revenue for year 1904 ..	5,839 7 0		Book Debts—Good	.. 14,862 0 0	
		8,163 8 8	*Less* Reserve for Discount, &c	2,532 0 0	
					12,330 0 0
			Patent Rights, Goodwill, &c.		17,500 0 0
			Cash in hand, and at Bankers		5,713 3 8
		£56,533 12 6			£56,533 12 6

REVENUE ACCOUNT to December 31st 1904.

	£ s d		£ s d
Directors' Remuneration	600 0 0	Trading Account..	7,042 16 9
Income Tax, Schedule "D"	435 0 0	Manufacturing Account	370 1 11
Law Charges and Fees	130 12 11	Repairs Account	218 16 8
Auditors' Fees	105 0 0		
Patents and Expenses	274 1 9		
Land Purchases Expenses	247 13 8		
Balance to Profit and Loss Account	5,839 7 0		
	£7,631 15 4		£7,631 15 4

PROFIT AND LOSS ACCOUNT.

	£ s d
Balance forward	2,324 1 8
Revenue Account	5,839 7 0
	£8,163 8 8

TRADING ACCOUNT FOR TWELVE MONTHS December 31st 1904.

	£ s d	£ s d		£ s d
To Stock-in-Trade at Depôts at 1st January 1903	..	624 18 2	By Sales	41,361 12 4
„ Factory Account—Machines and Parts supplied	..	24,361 12 4	„ Stock at Depôts at 31st December 1904 .. .	399 11 2
„ Sales Expenses—				
Travelling Expenses	600 13 6			
Advertising, &c.	976 5 4			
Postages, Telephone and Telegrams..	328 12 2			
Show Expenses	156 1 8			
Stationery and Printing	94 3 2			
Subscriptions, &c.	153 8 0			
Incidentals	53 0 10			
		2,362 4 8		
„ Agency Expenses—				
Liverpool	806 10 6			
London	1,186 9 6			
Glasgow	987 10 6			
		2,980 10 6		
„ Rents, Rates, Taxes, Head Office ..	520 16 8			
„ Salaries	1,200 16 9			
„ Carriage and Freights outward	1,724 11 3			
„ Discounts	515 11 9			
„ Legal Expenses	128 10 0			
„ Bad Debts	175 13 4			
		4,265 19 9		
„ Insurance	..	123 1 4		
„ Balance	..	7,042 16 9		
		£41,761 3 6		£41,761 3 6

TRADING ACCOUNT.—DETAILS.

		£ s d	£ s d
Sales Expenses:			
Travelling Expenses	General	120 10 6	
	U.S.A...	350 8 10	
	Continent	129 14 2	
			600 13 6
Advertising &c. ..	Periodicals	502 10 8	
	Dailies	238 6 4	
	Catalogues	108 18 2	
	Circulars	126 10 2	
			976 5 4
Agency Expenses:			
Liverpool	Rent	120 0 0	
	Rates and Taxes	40 10 6	
	Salaries	350 9 6	
	Commission	80 8 8	
	Office Expenses	215 1 10	
			806 10 6
London	Rent	206 12 8	
	Rates and Taxes	108 6 9	
	Salaries	560 10 9	
	Commission	146 9 8	
	Office Expenses	164 9 8	
			1,186 9 6
Glasgow	Rent	156 0 0	
	Rates and Taxes	78 6 6	
	Salaries	400 15 0	
	Commission	126 0 6	
	Office Expenses	226 8 6	
			987 10 6

MANUFACTURING ACCOUNT FOR TWELVE MONTHS, December 31st 1904.

	£ s d	£ s d		£ s d	£ s d
To Castings Account	7,069 17 11		By Production Account	..	24,435 2 8
" Fittings Account	5,655 9 1		" Sundry Sales, Scrap, Ashes, &c. ..	335 13 8	
" Wages direct	5,163 10 1		" Transfer to Renewals Account	296 4 10	
		17,888 17 1			39 8 10
" Salaries and Foremen	1,011 18 2				
" Coal and Power Account	2,341 16 2				
" Rent, Rates and Taxes	809 17 3				
" Insurance and Compensation	181 16 9				
" Maintenance of Works and Buildings ..	212 10 0				
" Drawing Office Salaries	420 0 0				
" Timekeepers and Works Office and Stores	340 15 6				
" Patterns and Models	116 9 3				
" Warehouseman and Carters	125 15 8				
" Incidental Charges	138 10 0				
" Packages Account	516 3 9				
		6,215 12 6			
" Balance to Revenue Account	..	370 1 11			
		£24,474 11 6			£24,474 11 6

COAL & POWER ACCOUNT.

			Dr. £ s d	*Cr.* £ s d
To	Coal—2,500 tons at 4/- d/d		500 0 0	
"	Coke—50 tons at 10/- d/d		25 0 0	
"	Electricity Wages		75 0 0	
"	Fireman and Engineman		130 0 0	
"	Oil Stores, and Packing d/d		120 0 0	
"	Water for Boilers		200 0 0	
"	Repairs to Machinery and Plant		450 0 0	
"	Depreciation 5 per cent. on £10,000		500 0 0	
"	Special Reserve for Plant, old Machines, and Renewals		500 0 0	
			2,503 0 0	
Cr.	Stocks on hand, January			
	Coal	£128 16 3		
	December 31st.	225 14 1		
			..	96 17 10
Cr.	Stores Oil and Packing.—			
	Stock Dec. 31st..	118 14 3		
	Stock January 1st	57 8 3	158 3 10	61 6 0
			£2,341 16 2	

CHAPTER III.

ORGANISATION.

For the purpose of clearly following the system of organisation the particulars of the Manufacturing and Trading Departments are here given.

Factory Operating.—

Machine Shop.—In which raw material in the form of castings, forgings, and stampings, are received into an initial Stores Department, from which they are delivered to the Machine Shop, as required, in job quantities. There are included under this heading several sub-divisions of the operating, arranged in view of specialisation of machines and operations, but which for the purpose of the book are taken as one shop.

Erecting Shop.—In which supplies of manufactured parts are received direct as purchased into a Stores Department, which also holds in stock a considerable number of machines in parts ready for erection.

Finishing Shop.—In which are received the machines erected and ready for painting, plating, or finishing from the Erecting Shop. It also receives some material, as paints, &c., which are included in Erecting Shop purchases.

Warehouses.—In which the machines are received from the Finishing Shop ready for despatch to customers and depôts.

Repair Shop.—

For the purpose of dealing with the repair and maintenance of the works and buildings, plant, parts and repairs to machines sent for renewal, making of patterns and models, and the general up-keep of the factory, a separate shop is established, conducted on entirely independent lines from the factory productive departments, and operating all the tool making for the Machine Shop. The principle on which this is based is that, where there are a number of men engaged in productive work, their time shall not be broken in upon by a number of minor matters which are better attended to by a department specially created for the purpose, or, in other words, the specialisation of repairs.

In the Manufacturing Account the sale of parts for renewals is the same as if full machines are sent out, and this forms part of the production.

The output of the Repair Shop comprises:—

Additions to Plant in the Balance Sheet,

Maintenance of Works and Buildings and Patterns and Models in the Manufacturing Account,

Repairs to Machinery and Plant in the Coal and Power Charges Account,

together with the sum of £218 16s. 8d. appearing in the Manufacturing Account under the heading of Sundry Repair Charges.

With regard to the allocation of any factory charges to this department, no account is taken of these, as, in the first place, the power for the Repair Shop is provided by a gas engine, and lighting by gas by separate meter. Wages include foreman and assistant storekeeper, and, therefore, the basis of the Repair

Shop is that it shall be entirely independent of the factory for power and light and heat, so as to be self-contained, and run when the factory is standing. The expenses are capable of separate classification, and for all purposes of account the Repair Shop might belong to another firm.

All purchases are debited to this department direct, and wages are paid through a separate Wages Book. The Departmental Account is made up separately from the Manufacturing Account, and the balance is carried direct to Revenue Account.

In the case of businesses where the repairs undertaken for customers form any considerable part of the output, a deduction would require to be made from the total factory charges in respect of same before the allocation of the factory charges on the unit machine basis. In the case in point, however, the charges for repairs invoiced form only an insignificant part of the Repair Shop output, and no proportion of general indirect charges is allocated, as this would only diminish one heading of the factory charges to increase another.

Factory Technical.—

Works Office, including Works Superintendent, Costs Clerks, Time and Store Clerks, which prepares and issues all production and repair orders, and in which the Cost Accounts relating to the production are kept and estimates prepared.

Drawing Office, which is practically a sub-department of the Works Office, and in which all drawing designs, models, and new types are originated.

Factory Offices.—

Purchases Department.—Dealing with all purchases of raw materials, stores, &c., and responsible for the provision of supplies.

Counting-House.—Responsible for payment of wages, Ledger Accounts for all goods inwards, and preparation of the Pay Bill, for which cheques are drawn by the Head Office. Factory advises goods sent out, which are invoiced by the branches.

Head Office.—

Controlling finances, depôts, and responsible for direction of business generally. Continental and export business transacted by Head Office. Making all payments for Factory and Depôts.

Depôts.—

London, Liverpool, and Glasgow, operating sales in their districts, keeping District Sales Ledgers, and collecting accounts and remitting to Head Office. Only Petty Cash payments made.

Works Office.—

For the purpose of cost-keeping the organisation of the Works Office is a matter of special interest. On the efficiency of the records depends practically the whole value of the system of accounting. In the case of our illustration the efficiency of the Works Office and Factory is shown by the comparatively small expenditure in salaries.

This economy in expenditure has only been obtained after considerable experience, and the outlay in previous years under this head has been much greater, and has decreased in almost exact ratio with the introduction of labour-saving devices in the Works Office. The equipment of the Works Office is a matter which should command the closest attention in the case of the institution of a system of cost-keeping, not only from the point of economy in revenue charges, but principally in the economy of effort required to obtain the necessary records.

The assistance which can be obtained from special devices and methods is not yet fully appreciated, although there has been some considerable development of late years in the direction of Card systems and Filing methods.

If we take the Card System for one illustration. The cabinets are all in this case classified to the cost schedule, and the fronts of the drawers contain a glass panel, in which is shown the latest card record of the cost, stock, or other particulars.

For instance, the ANO cabinet will show on the drawer fronts the last Weekly Stock Cards from each warehouse. The previous week's cards are in the drawer behind it ready for reference, and the convenience of reference to the whole of the current records under each machine or shop classification is a very considerable factor in obtaining the Weekly Summaries, which can be read off with a minimum of effort.

In the same way the calculations required weekly for the purpose of compiling the Weekly Stock Cards are all tabulated on the basis of a ready reckoner, and in this case the top of a counter on which cards are sorted for the cabinets is covered with a glass top, under which are the tabulated figures, which are read off by one clerk to the other.

The wall of the Works Office on one side is divided into panels, into which are fitted trays, standing vertically, with glass fronts. These trays are something like slates, and the Weekly Summaries, which are prepared on foolscap sheets 13½ in. by 8½ in., are placed therein, the last one being readily inspected while the previous week's are held behind in the tray for reference.

In the case of the Works Office, this is a long room, lighted at the top from the north, and has one long

desk (double) running down the centre, the counter and entrance being at one end, and the other end connecting to the Factory Manager's Office. There is a space of about twelve inches between the desks, and instead of the ordinary brass rails this space is utilised for glass panels, in which are shown the whole of the details of each machine cost, decimal notations, and memoranda required for wages, &c.

There are several other devices of a similar character, designed specially for reducing the clerical labour involved in computation, and adopted in the first place with a view to expedite the preparation of the periodical returns, and also the further details required by the Works Management. Upon the Weekly Return being prepared, it is only necessary for the manager or head draughtsman to walk along the cabinets with the return, to be provided with the whole of the details connected therewith, and there is no waste of time in taking out and returning cards.

Considerable advantages are secured by the adoption of colours for each department.

The failure of many systems of cost-keeping lies in the time involved in the compilation of the records, and connected therewith the expense involved.

The arrangement of the warehouses follows the order of the cost schedule, and bins and stalls are provided for every part, and racks for the raw material.

Each bin, stall, or rack has a Stock Card attached, on which is enumerated the movements of the stock, and showing the balance in hand at the end of each week. It is from this card that the Weekly Stock Cards are prepared, and the Bin Cards also give the numbers of the Transfer and Job Tickets by which the parts are moved.

The following Bin Ticket will show the way in which this is carried out, and is representative of all:—

ANO. CAM AND BLOCK. 2/4 No. 46

Date	No.	Inwards	Date	No.	Outwards	Date	Balance
1904			1904			1904	36
Oct. 21	19	30	Oct. 23	92	20	Oct. 20	46
28	17	10	29	103	40	23	16
Nov. 4	15	20	Nov. 2	121	10	27	26
11	16	50	9	111	20	Nov. 4	56
Dec. 2	14	40	28	103	40	9	&c.
9	11	10	Dec. 6	95	32		
16	13	10	18	93	36		
20	18	20	21	97	10		
22	17	10					

In this case the Inwards represents completed parts from the Machine Shop, and the Outwards the parts to the Erecting Shop for making up. The bins are all placed so that they are readily inspected, and advantage is taken of actual counting at regular intervals to provide against error.

In the case of Shop Records, the multiplication of cards is to be avoided, and the necessity for same should be made imperative before adoption. It is easy to introduce forms and records, but unless they are to be permanent their utility is doubtful, and every additional card means extra labour and additional opportunity for error.

So far as periodical Card Records are concerned, to the extent to which they initiate revision of stocks they are important,

but they should in all cases complement, and not substitute, the ordinary supervision of the manufacturing operations. When the last word has been said on the side of records they are far inferior to the visible inspection of the eye of the manager, and there is nothing in writing which appeals to the graphic senses. To the trained expert in figures, who has probably never realised the solidity of the actual facts expressed in them, records are effective; but, to the practical man, an increase in stock represents to the eye a visible overflowing of the facilities provided by normal routine, and connects a number of other considerations with same. In shop records writing should, if possible, be dispensed with, and stamps and punches provided for checking purposes. The location of the record should signify its position in regard to the shop operating. It is easier to pass a card from one tray to another, indicating the completion of one operation thereon, than to write it down, and an inspection of the trays showing the number of cards in one as compared with that from which they are taken is quicker and simpler to the eye of supervision. In such cases trays are provided, in which the cards stand on their edges, similar to the boxes containing lantern slides, and disclose at a glance the position of the operating.

Finally, in the case of Cost Records, the proverb "Bis dat qui cito dat" applies with special significance; and a system which provides a Weekly Summary on Tuesday is vastly superior to a more elaborate one, in which the results are not obtainable till Thursday.

CHAPTER IV.

MANUFACTURING ACCOUNT.

In the accounts as presented in Chapter II. there is no special difficulty in arriving at the figures by ordinary book-keeping methods, and the only items calling for special comment are the following:—

Dr.				*Cr.*
	Castings Account		Production Account	
	Fittings Account			
	Coal and Power Charges			

The remainder of the headings comprised in the Manufacturing Account come from the Cash Book, and require no explanation, being actual payments.

Castings Account.—

This is the debit for purchases from the Invoice Day Book, which, however, contains an additional column, into which the invoices are carried in addition to the usual abstract, and which provides a comparison of price with that of the assumed average price of the articles purchased.

Fittings Account.—

This is treated in exactly the same manner, and at the end of the year the stock is credited. In this case half the savings effected in purchases, as compared with the standard prices, are deducted from the stock figures as a purchase reserve. The special method of dealing with purchases will be found in Chapter V.

Coal and Power Charges.—

It may be, perhaps, regarded as unusual to include under this head some charges which in ordinary Trading Accounts would appear under separate headings. The full details are, however, given in the summarised Nominal Account set out, and the convenience of the grouping is considerable, as it embodies the whole of the expenses of operating the factory for power and light, and provides a basis for division into departmental costs.

Depreciation.—

Under this heading will be found a charge for deprecation of 5 per cent., which represents what may be called the statutory provision for this purpose, and which figure is shown on the face of the Balance Sheet. The further provision of 5 per cent. is treated separately, and is placed to a special Reserve Fund in the Balance Sheet, which enables the management to deal with old machinery and renewals with a freer hand than would be the case if the figures were carried into the Plant Account. Practically, the depreciation charges are split into two portions, the principle being that, to maintain the factory at its full economic production, the sums reserved for depreciation should be actually expended annually on the plant, and that this special provision is by way of equated renewals.

A great deal of discussion has taken place on this subject, but the principle adopted is that in a going concern there should not be, with effective management, any depreciation of plant whatever, or, if so, the economic production is endangered. On the other hand, the wisdom of writing down the plant to a residue value is granted in the depreciation charges carried to the Balance Sheet.

Production Account.—

As far as the debit or cost of raw material and expenses are concerned, these are readily ascertainable by dissection of the

accounts by ordinary methods, but the credit entry against these debits is the actual production of the Factory or Manufacturing Department, and this brings us to the opening of Factory Accounting as separate and distinct from the ordinary commercial books.

In some businesses the item of Factory Production Value is already obtainable, in that the Factory is credited, and the Sales Department debited, with all machines or products turned out at an assumed cost figure.

There are also instances where the factory production is capable of measurement in value by outside competition. There is sometimes the alternative of manufacturing a special product, as against its purchase from some outside manufacturer. In such case the price at which the product can be obtained elsewhere is the measure of value of the factory production, and in such case the salaries of the factory management and the interest on capital represent the same margin as the profit of the outside factory.

In other cases the provision of patterns, designs, &c., and the special finish of the goods, necessitate the manufacture being operated by the selling firm. In the case of the illustration taken for the purpose of elucidating the Unit System of costing, these circumstances apply.

In any case, the crux of the whole system of Factory Accounting rests on the balancing of the production value with the consumption of raw material, wages, and expenses of producing same; and what we ask of the factory accountant is the carrying out of the cost system so that, excepting the ordinary fluctuations in the prices of raw material, savings in labour, coal, and charges, the factory production values on the credit side shall

balance the purchases, wages, and charges incurred and debited to the Factory Account on the other side, with the result that the Factory Accounts will show cost, neither more nor less.

We pass, therefore, to the question of the production value of the factory, and a consideration of the questions involved in same with regard to its position as forming the credit side of our Manufacturing Account.

It will be noticed that the credit to the Manufacturing Account is a sum of £24,435 2s. 8d., representing the factory production for the year, and the adjustment of stock makes the agreement between this figure and the debit appearing in the Trading Department Account for the goods transferred from the factory for sale.

With this we come to the consideration of the Unit System and its development in the Factory Accounting.

The first step is the compilation of a schedule of the costings in a summarised form. It assumes that for every machine or article produced a proper detailed cost estimate is prepared, giving details of each part and the direct labour involved therein, and showing the actual prime cost of manufacture.

The Factory Charges are fixed by taking the prime cost of the first machine, A.E.D., and dividing this into the total Factory Charges in the Manufacturing Account on an assumed basis of a weekly output equivalent to 70 A.E.D. machines per week, or 3,500 for the year of 50 weeks.

This is obtained by a consideration of the works records in output, and shows that for profit-earning and expenses, both of factory, trading, and dividends, a basis of 70 A.E.D. machines

at the average cost and selling price will be required to fulfil these requirements.

The A.E.D. machine, therefore, becomes our unit of output, and the Factory Charges are charged on the prime cost of the other machines in the proportion of their prime cost to the prime cost of the unit machine A.E.D.

Taking the accounts as presented, we find that these requirements are as follow:—

Factory Expenses..	£6,415 (£200 advance)	
Trading Charges	9,732	
Revenue Charges (say)	1,300	
Estimated Profit	6,000	
		£23,447

while the A.E.D. machine at an assumed selling price of £12, and a prime cost of £5 5s. 10d., will, on the sale of 3,500 machines per annum, produce a margin of £23,480 on the estimated figures of the cost schedules.

The output of 3,500 machines of the A.E.D. class is carefully compared with the Works Records, and is seen to represent the fair maximum output which can be produced from the plant.

In the chapter on Factory Units we deal further with this question, and will now, therefore, pass to the compilation of the production figure at the credit of our Manufacturing Account.

The following schedule shows the range of products manufactured by the undertaking whose accounts and business are submitted as an illustration, and it may be specially pointed out that the table of costs here presented affords very considerable

variation in the components of the various machines produced. The ratio of Selling Price, Factory Cost, Wages, and Factory Charges are fairly comparative with the actual conditions prevalent in most manufacturing industries, in which, by reason of competition and other conditions, the actual selling price of the product bears only an indifferent ratio to the actual cost of production.

TABLE A.

SCHEDULE OF FACTORY COSTINGS.

Class Average		Selling Price	Cast-ings	Fittings	Wages	Prime Cost	Factory Charges	Factory Cost
£ s d		£ s d						
11 15 0	A.E.D.	12 10 0	45/10	25/-	35/-	105/10	37/-	142/10
	A.T.F.	12 10 0	40/-	22/-	28/-	90/-	31/8	121/8
	A.F.F.	11 10 0	35/-	20/-	24/-	79/-	27/10	106/10
	A.N.O.	10 10 0	28/-	18/-	22/-	68/-	24/-	92/-
9 0 0	B.A.F.	10 10 0	35/-	15/-	20/-	70/-	24/8	94/8
	B.A.E.	9 10 0	33/-	18/-	14/-	65/-	22/9	87/9
	B.F.A.	8 10 0	25/-	30/-	10/-	65/-	22/9	87/9
	B.N.E.	7 10 0	25/-	22/-	15/-	62/-	21/10	83/10
7 2 6	C.A.E.	9 0 0	40/-	10/-	7/-	57/-	20/1	77/1
	C.E.F.	7 10 0	30/-	15/-	10/-	55/-	19/4	74/4
	C.O.T.	6 5 0	25/-	12/-	20/-	57/-	20/1	77/1
	C.X.A.	5 15 0	20/-	15/-	11/-	46/-	16/2	62/2
6 0 0	D.A.B.	7 10 0	25/-	18/-	16/-	59/-	20/9	79/9
	D.A.E.	6 10 0	24/-	16/-	12/-	52/-	18/4	70/4
	D.A.G.	5 10 0	20/-	20/-	8/-	48/-	16/9	64/9
	D.E.F.	4 10 0	18/-	16/-	12/-	46/-	16/2	62/2
3 10 0	E.X.B.	4 10 0	20/-	10/-	10/-	40/-	14/1	54/1
	E.A.F.	3 10 0	10/-	15/-	8/-	33/-	11/7	44/7
	E.B.X.	3 5 0	8/-	16/-	10/-	34/-	12/-	46/-
	E.C.C.	2 15 0	6/-	8/-	12/-	26/-	9/2	35/2
3 0 0	F.A.B.	4 0 0	10/-	12/-	10/-	32/-	11/3	43/3
	F.E.A.	3 10 0	12/-	10/-	11/-	33/-	11/7	44/7
	F.C.C.	2 10 0	5/-	6/-	14/-	25/-	8/10	33/10
	F.A.N.	2 0 0	5/-	5/-	8/-	18/-	6/4	24/4

It is now required to convert the figures of the costs in Table A into units, as shown by the following table, and for the purposes of comparison of costs the Unit System will be found to possess considerable advantages.

TABLE B.

	Factory Cost	Castings	Fittings	Wages	Establishment Charges	Castings and Fittings	Prime Cost
A.E.D. ..	1·000	·318	·176	·246	·260	·494	·740
A.T.F. ..	·852	·280	·154	·196	·222	·434	·630
A.F.F. ..	·748	·245	·140	·168	·195	·385	·553
A.N.O. ..	·644	·196	·126	·154	·168	·322	·476
B.A.F. ..	·663	·245	·105	·140	·173	·350	·490
B.A.E. ..	·615	·231	·126	·098	·159	·357	·455
B.F.A. ..	·615	·175	·210	·070	·159	·385	·455
B.N.E. ..	·587	·175	·154	·105	·153	·329	·434
C.A.E. ..	·539	·280	·070	·049	·140	·350	·399
C.E.F. ..	·520	·210	·105	·070	·135	·315	·385
C.O.T. ..	·539	·175	·084	·140	·140	·259	·399
C.X.A. ..	·435	·140	·105	·077	·113	·245	·322
D.A.B. ..	·559	·175	·126	·112	·146	·301	·413
D.A.E. ..	·492	·168	·112	·084	·128	·280	·364
D.A.G. ..	·454	·140	·140	·056	·118	·280	·336
D.E.F. ..	·435	·126	·112	·084	·113	·238	·322
E.X.B. ..	·378	·140	·070	·070	·098	·210	·280
E.A.F. ..	·312	·070	·105	·056	·082	·175	·231
E.B.X. ..	·322	·056	·112	·070	·084	·168	·238
E.C.C. ..	·246	·042	·056	·084	·064	·098	·182
F.A.B. ..	·303	·070	·084	·070	·079	·154	·224
F.E.A. ..	·312	·084	·070	·077	·081	·154	·231
F.C.C. ..	·237	·035	·042	·098	·062	·077	·175
F.A.N. ..	·170	·035	·035	·056	·044	·070	·126

The application of the principles underlying the selection of the unit to outputs of different characters will be found further set out in the chapter under the heading of Factory Units.

In all factories producing a variety of machines in design, cost, and price, a number of parts will be given out for manufacture. In the case of a cycle company, probably six dozen hubs will be one job, while another may be one dozen wheels of a particular pattern.

Now, if all machines are represented by a decimal part of the standard machine, it follows that all the parts of all the machines will also represent a decimal of the standard, and as such be equal to some part of the unit machine.

Instance.—B.A.F. machine is ·66 of our unit machine A.E.D., therefore the various parts of the B.A.F. machine will build up the ·66 decimal, and may be thus expressed.

It follows, therefore, that any multiple of any part of B.A.F. machine may also be expressed in decimal value of A.E.D. machine.

Presuming that A.E.D. is a £10 10s. cycle, and B.A.F. is a £5 5s. cycle,

Then as the B.A.F. machine may be ·50 of A.E.D., the hub of a B.A.F. machine may be, say, ·025 of A.E.D.

Six dozen hubs of B.A.F. machine at ·025 is equal to 1·8 units.

Thus the six dozen hubs will be 1·8 units of our required 70 units output per week.

In dealing with this matter 10, and multiples of 10, articles would be made, instead of dozens, for readiness of calculation.

It may appear that this is opening the door to a countless number of calculations, but when it is remembered that our basis is a constant factor of 142/10, one sheet of foolscap will give all the calculations in parts of 142/10 ready for reference, while a great number of entries require merely moving the decimal point, as:—

10 parts	..	·015	.. ·15
100 ,,	..	·015	.. 1·50

It follows that to obtain the output of 3,500 units, which may be composed of completed machines, partly completed machines, and parts, this will be comprised according to the orders sent in of a varying number of machines (or equivalents), and the attainment of the ideal number of output units will vary from week to week as the weekly production varies.

INSTANCE	Classes							Total
	A	B	C	D	E	F	Total	Units
Standard ..	10	20	15	30	40	50	165	70
One Week ..	10	10	10	40	60	35	165	64·6
Another Week.	20	20	20	40	20	10	130	70

This comparison illustrates the great advantage in the expression of the output in units of the A.E.D. machine. As will be seen, it is quite possible that the average number of machines may be obtained, and yet give a shortage in earning capacity, while a smaller number of machines may give an increase in effective units of output on the standard.

By the expression of the output in units, the effect of these variations is readily ascertainable.

Table C shows the costings on the actual output of the various machines for the previous twelve months, and gives the sum of the total costings in comparison with the estimated costs on the unit of the A.E.D. machines, on the basis of 70 A.E.D. machines per week.

TABLE C.

		£ s d		£ s d
Estimated Annual Output of 3,500 A.E.D. Machines is equal to	Castings ..	8,020 16 8	Actual Output in Machines in all the different classes worked out to	7,217 10 0
	Fittings ..	4,375 0 0		5,707 0 0
	Wages ..	6,125 0 0		5,095 0 0
	Expenses ..	6,475 0 0		6,415 12 8
		£24,995 16 8		£24,435 2 8
3,500 A.E.D. Machines, Prime Cost ..		£18,375	Actual Output ..	£18,020 0 0

It will be seen that the working out of the manufacturing figures, based on the ideal standard of 70 A.E.D. machines per week, is comparable, in that while the elements of the cost have varied considerably, owing to the variation in the character of the output, giving a greater amount of finished goods as

fittings, and consequently a reduction in wages cost, the actual results are fairly comformable, and, above all, the allocation of the oncost is complete within £60.

The actual number of machines (and parts) was equal to 8,250 machines in the year.

The figure of £24,435 2s. 8d. gives the credit to the Manufacturing Account, which thus shows on the credit side the estimated value of the production on the cost schedule, and on the debit side the actual expenditure and cost against these figures.

CHAPTER V.

PURCHASES.

THE *allocation* of purchases is chiefly a matter of the analysis of the Bought Day Book, Purchases Journal, or by whatever name the Day Book is known, into which the invoices are entered, and which becomes the first book of record under this heading.

In this particular illustration the purchases consist of raw material in the shape of castings and forgings, which are required to be manipulated into various finished parts in the manufacture of machines, and which commence their voyage through the works in the Fitting or Machine Shop. Each invoice as received for this class has originated in a Works Order from headquarters for the production by the factory of a number of machines of some special specification and designation. It does not particularly matter whether the castings and forgings for our purpose are purchased in that state, or whether the iron or steel is purchased and the castings and forgings made by the firm, the only difference being the carrying back of the costing a further stage in the development of the system.

In the particular illustration selected, however, the forgings and castings are purchased in that state, and the invoices are, therefore, for a certain number of castings and forgings. Let us suppose that ten A.N.O. machines are to be produced, then castings and forgings for that number of machines are ordered.

In the case of ten A.N.O. machines, the castings (this includes forgings) represents ·197 of the unit machine, and therefore the invoice is entered as shown in the form below:—

No.	Date	Name	Description	Amount	Dept.	Units
1	Jan. 1	Leeds, F.	10 A.N.O. $\frac{2}{4}$	£14	F. S.	1·960
2	Jan. 2	Jones & Co.	10 A.N.O. $\frac{1}{8}$	£9	E. S.	1·260

In these examples the invoice price is assumed at the costs basis, but in actual practice the invoice price fluctuates, and this is worked out in a further column. (See specimen, p. 34.)

So far as the commercial books are concerned, the ordinary system is followed, but the metric figures are posted into the Castings Account, special columns being ruled for them, and carried on into the monthly totals.

The monthly totals, therefore, show (and the same remarks apply to any shorter or longer periods) that the purchases for the period amount to 21·36 units, which are divided—

Fitting Shop Stock	20·10
Erecting Shop Stock.. ..	1·26
	21·36

In the Purchases Accounts there are, however, balances of the metric figures of 21·36 − 19·435 = 1·925 units, which show the variation in the price of the raw material for the period from the cost figures.

The figures carried forward for return purposes show (see p. 64), in the first place, that the total purchases received were equal to 21·36 units; the division to the Departmental Purchases Account and the balance in the Unit columns shows the fluctuation in the prices of raw material for the period.

Now the balance gives 1·925 units, which is equal in money value to £13 14s. 11d.

The unit figures thus obtained are charged to the Fitting Shop and Erecting Shop Departmental Accounts, and constitute the cost units for the material sent in to those departments. The credits to these departments against this consists of the finished parts from the Machine Shop to the Erecting Shop, and from the Erecting Shop to the Paint Shop in completed machines.

The Departmental Accounts also receive the actual wages debit in units, and the balance represents work in progress and units in stock.

The actual working out of these figures, however, will be seen in the chapter on "Periodical Returns," which shows the focussing of the Unit System to each department.

There are, in addition to the above instances, Coal, Engine Oil, Stores and Packing, Paint, Oil, Colours, &c., which are analysed out to the various accounts as in the ordinary methods of purchase analysis.

The paint, oils, and colours for machines, however, are debited to the Erecting Shop Stock in exactly the same method, the allocation of these items being based on the unit of the A.E.D. machine.

It may perhaps be argued that the fluctuations in the prices of raw material would necessitate an alteration in the costings and the standard; and this is quite true, if the movement of prices were a permanent one, but actual experience goes to show that over a period of twelve months there are always fluctuations, both for and against, and in dealing with a mutiplicity of parts, as in this industry, these fluctuations will average themselves.

The valuations of the fluctuations in units for the periodical returns disclose sufficient information for the management to

deal with any question of increase in selling price which may arise, or which may affect this department.

A further argument is that this is not cost, but the *raison d'être* of factory accounting is to show the efficiency or otherwise of the methods of production, and whether raw material increases in price or diminishes in price (within normal limits) it does not increase or diminish the effectiveness of production. In the case, however, of alteration and economies of design and of construction taking place within the year, or of bringing out a new machine, these do not affect the problem in any way.

You may omit from or increase the schedule in any way found necessary, for, so long as the unit is preserved, the alteration of its components does not affect the system.

We claim, therefore, as regards the purchases, that the adoption of the Unit System discloses the exact proportions of the buying; that, with very little clerical labour, it is not only possible, but easy, to keep a record of the purchases under each machine number, and so to keep a watchful eye on the efficiency of the buying and the accumulation of stock.

The Stock Returns, however, come under their special chapter, to which we refer the reader for fuller details.

In some businesses, however, it is customary to have raw material which it is possible to utilise for different varieties of machines, and a cam in this particular industry may do duty for D.A.G. or E.B.X. machine indiscriminately, the difference being in the Fitting Shop work upon it.

In such a case the unit value of this particular part in the purchases being identical, the system is not affected, and we may assume that it is not intended to accumulate, say, 100 cams in stock without the other parts.

SPECIMEN OF PURCHASE DAY BOOK.

January 1904.

Day	No. of Invoice	Name	Description	Weight	Value	Cost Units	Cash Units
				T. c. q. lb.	£ s d		
1	1	Leeds Forge Co...	10 A.N.O.$\frac{3}{4}$ ..	1 5 0 0	14 0 0	1·960	1·960
2	2	Jones, E. & Co. ..	10 A.N.O.$\frac{3}{4}$ ..	..	9 0 0	1·260	1·260
4	3	Leeds Forge Co...	50 C.O.T.$\frac{3}{8}$ ..	5 18 2 0	60 0 0	8·800	8·450
5	4	Guttridge & Co...	100 E.B.X.$\frac{1}{2}$ ..	..	37 10 0	5·600	5·250
8	5	Smith, H. & Co...	10 B.F.A.$\frac{3}{8}$ ..	0 18 2 0	11 10 0	1·760	1·620
12	6	Leeds Forge Co...	20 D.A.G.^{5} ..	0 5 0 0	4 10 0	·700	·630
14	7	Do. ..	10 D.A.G.^{4} ..	0 4 0 0	1 18 0	·280	·265
					£138 8 0	21·36	19·435

ABSTRACT :—

Machine Shop ..	20·10 units
Erecting Shop ..	1·26 "
	21·36

Every invoice for the factory is certified by the Works, and is entered into a Material Day Book similar in all respects to the Purchase Day Book. This is summarised weekly, and abstracted to each department in units. Coal and other general invoices are likewise entered, and abstracted at the bottom of the page to their proper accounts.

The Journal entry for these is a debit to the Departmental Account and a credit to Purchases. Departmental Accounts are opened for each shop and stores, to which are debited the special purchases belonging to it.

In the case of Coal, Coke, Oils, Stores, and Packing, these items are obtained by direct debit from the Cash Book on payment of the accounts, and there are separate Nominal Accounts raised in the Manufacturing Ledger for each heading.

The method adopted in dealing with the goods inwards is more particularly set out in the chapter on Stocks.

A separate Purchase Book is kept for Repair Shop Purchases, in which the purchases are abstracted.

It may appear at first sight that the organisation of this business possesses considerable advantages for the application of the Unit System, in that the purchases are largely identified with each product, and can thus be separately recorded.

In the case, however, of a cycle business purchasing tubing, &c., in considerable quantities, or of the purchase of bar iron in other industries, the determination of the unit in the original purchase is equally easy. We may assume that some sizes are for special machines, and that other sizes may be used indiscriminately for any machines.

In the case of special sizes, all that is required is the division of the total quantity by the quantity necessary to provide the tubing for one machine, as, say, 3,000 ft. of 1 $\frac{5}{16}$ in. tube is invoiced, and this is for No. 10 Safety; 3,000 ÷ 6 ft. 3 in. (the tubing required for No. 10 Safety) gives us 480 pieces, and this is equivalent afterwards as if it were 480 A.N.O. brackets. (See Purchase Day Book.) The 6 ft. 3 in. includes allowances for waste.

With regard to the other sizes, which are used generally, the debit is to the Stores in the first place, and the credit to the Stores is upon the Job Order Card for materials. Thereupon the tubing as it is given out, say, for ten No. 10 Safety frames, assumes the unit figure of this equivalent in the decimal of No. 15 Safety, which is the unit machine, as, say, ten No. 10 Safety frames at ·325—3·250 units. Thereafter it follows the ordinary course through the shops on its original purchase value in unit decimals.

With regard to the Stores Department itself, there is no difficulty in measuring its stock in 1,000 ft. lots as units, because as the costings for every machine are expressed in decimals of the unit machine, it follows that every inch of tubing represents the same ratio in decimal units, no matter for what machine it is purchased or used.

If we may assume that one foot of 1¾ in. by ½ in. bar iron is ·060 of A.E.D. unit, then it follows that 1 ft. 6 in. of the same bar iron, if required for B.A.F. machine, will represent ·090, and so on throughout the whole of the general stock.

Practically the only effect of the purchases in general stock instead of in specific is to put the storekeeper in the case of purchases general in the position of the firm invoicing the goods in the case of purchases specific.

In all cases, however, any differences in price are taken direct from the Purchase Book in units to Bar Iron or Tubing Account, and appear there in lieu of disturbing the whole of the costings in the Works for a temporary fluctuation in price.

As in the case of the Wages Job Tickets, so in the case of the Purchases. Every invoice is dissected for each purchase affecting any machine number, and the quantity, price, cost unit, invoice price, unitised and noted on a card which is filed under the machine designation in the Works Office card cabinet.

CHAPTER VI.

WAGES.

Direct Labour.—

In this particular industry the wages of direct labour are all piece-work, and, the parts being comparatively small, the jobs are given out in series of ten, so as to allow of metric enumeration.

In the building up of the schedule of costs given in Table B each part is separately scheduled on piece-work rates, and in addition carries its decimal equivalent of the general unit value.

The specialisation being carried to full length, one man may make a certain part of a dozen different machines, and finishes his order, which may be, say, for boring 100 D.A.G. brackets. So far as his wages go, they are made out in the ordinary Piece-work Tickets, but a separate column is provided, in which the unit values are noted, and the addition of the Total Wages Ticket is also equal to an addition of so many unit decimals.

The Wages Book contains only—

	£	s	d		Units
John Jones	1	12	10	..	·325
Wm. Smith	1	7	8	..	·270

It will be seen, therefore, that the total of each group of direct labour carries with it the equivalent unit value in production, and by this means the weekly wages are equal in sterling to an equivalent in decimals.

Wages.—

Wages are abstracted from the General Wages Book weekly, and are detailed in the Cash Book on payment.

Wages, Indirect Salaries, and Foremen.—

In actual practice, and for the convenience of paying and allocation of wages, three or more Wages Books are provided—one for each shop, and one for general charges, from the last of which this debit is obtained in regard to the wages. The salaries are also obtained from the Cash Book payment.

The total wages from each departmental Wages Book are likewise debited to Machine (or other) Shop Wages and credited to a Total Wages Account.

The wages from the General Wages Book are classified and abstracted to each special heading, such as:—

Machine Shop—Indirect Charges.

Erecting Shop—Indirect Charges.

Coal and Power—Wages.

Maintenance—Wages.

New Plant—Wages.

In this case the new machines are made on the premises, and under a special order number, to which wages and material are charged direct as purchased.

Repairs to Plant.—

A special shop is organised for this and for new plant, and the wages kept separate in the General Wages Book. Time Sheets are kept, and the repairs are classified. Tools are renewed and made here, and stock for this department is kept separate, and given out separately. The Carpenter's Repair Shop adjoins, and is run on the same basis.

Time Work.—

It would appear that for the adoption of the Unit System the piece-work method of payment of wages was essential, but it is perhaps one of the strongest recommendations of the system that the measurement of the effective production is simplified in the case of payment of wages by the hour rather than in the case of piece-work.

In this case the Wages Book is either divided departmentally, or separate Wages Books are provided for each department. Where the number of employees is sufficiently large the provision of separate Wages Books will be found a great convenience and saving in time, both in making up, checking, and paying out for the cashier. Taking the Fitting Shop Wages Book as an illustration, instead of the jobs being specified the men are classified, and details carried into columns, as—

Fitters, Turners, Shapers, &c.,

and the wages are carried out to totals in this abstract.

The credit for the wages comes out in the slips to the Erecting Shop Stores, giving the number of articles of each class finished and put into Stores ready for the erectors. The unit value of each slip is totalled, as, for instance—

ERECTING SHOP STORES TICKET.

Week ending June 24th 1904.

	Totals
17 E.A.E. Brackets, drilled and slotted	·0476
11 D.A.G. Pulleys, bored and fitted	·0371
13 A.N.O. Cams, bored and tapped	·0312
20 A.N.O. Shafts, turned, and collars fitted	·0360
	·1519

Passed by
Received by
Foreman's Signature

It will be seen, therefore, that we get here first the cash value of the wages, and also, in the second column, the value of the finished product.

We have therefore not only the credit against the weekly wages, but the credit as against the material delivered to the Fitting Shop, which has now completed its first stage of progress. The jobs, as given out by the foreman, are made out on cards, and the actual time, &c., is noted, just the same as it would be in the case of piece-work, and, when completed, are filed in the division of the card cabinet under the designation of each machine and its parts, thus—

Factory Order A.1259.								A.N.O. 2/4
Job. 100 A.N.O.	Brackets to Bore and Tap.							
Name.	EDWARD JONES, Rating 2843.							
Date given out and finished.				June 19/04.			June 26/04.	
Time.	T.	F.	S.	M.	T.	W.		Total
E. Jones	4	7	5	..	..	..	..	16
W. Wilson	3	5	4	..	..	..	..	12
Apprentice	2	2	1	..	..	..	..	5
								Initials.
To Stores. Week ending June 24th, 190							50	E.T.
Do. July 1st, 190							50	E.T.
Do.								

This card is sent in with others every week to the Works Office, from which it originated, and forms the basis of the calculation of the unit values of the wages estimate. It is there

filed away under A.N.O. $\frac{2}{4}$, and by this means the Works Office notes on a Front Summary Card the date and the actual and estimated unit values, thus—

								A.N.O. $\frac{2}{4}$
Week—						Units.	Cost Units.	Balance.
June 24/04 ..	..	..	..	..	100	·0038	·0040	·0002
July 22/04 ..	..	..	..	..	50	·0037	·0040	·0003
Aug. 8/04 ..	..	..	..	..	100	·0038	·0040	·002

CHAPTER VII.

DIRECT AND INDIRECT CHARGES.

It will be noticed that the material and charges in this case are grouped under four divisions, which follow:—

(1) Castings or Raw Material.

(2) Fittings or partially manufactured or wholly manufactured goods.

(3) Wages or Direct Productive Labour.

(4) Factory Expenses, which include the following:—

Coal and Power and Lighting Charges.

Wages (Indirect and General), Salaries and Foremen.

Rent, Rates, and Taxes, Insurance and Compensation.

Establishment Expenses, including:—

Maintenance of Roads and Buildings.

Drawing Office Salaries.

Timekeeper and Works Office Stores, &c.

Patterns and Models.

Warehousemen and Carters.

Packages.

Incidental Charges.

Practically the group No. 4 includes the whole of the expenses of operating the factory.

Considerable divergence of opinion exists as to the basis on which indirect expenses should be calculated to give the aggregate on each individual unit of the production, which will produce the sum required at the end of the year to meet the factory charges and expenses.

Some authors have favoured the allocation on labour only, and productive labour only, and this view is apparently based on the theories of the political economy of a past generation, which forbade any accretion of wealth except by the use of labour only. No doubt as an axiom, which depends for its application on the relation back of all matters to a primitive condition, this may be true, but in a set of Cost Accounts we have to deal with the exact conditions existing in the particular businesses dealt with. One manufacturer may, and does, buy his material in a raw, or more or less finished, stage, according to his capital and conditions of the organisation of his business; another may supply his factory with coal from his own collieries, iron from his mines, pig iron from his blast furnaces, and so on *ad infinitum*, and the cost of the raw material in one case includes the profit of the distributor and not in the other.

The matter is not one of principle, but of conditions. What is required is an actuarial calculation, as in the case of a life insurance company, to find the basis on which a loading can be fixed which, multiplied by the unit of production, will amount to the aggregate sum required.

There is, perhaps, no more important matter in connection with costing than the allocation of indirect expenses, or what is classified in this volume as "Factory Charges." Where a fluctuating output exists in a variety of products, any of which may, and does, often aggregate to a higher proportion of the

total output than is anticipated, it is bound to throw an untrue loading aggregate at the end of the year. Changes in the character of the factory production are of constant occurrence, are far-reaching in their character, and cannot be foreseen or provided for. It is often found that these changes may throw out valuable plant and machinery, or render it only partially occupied.

In the Unit System of cost these considerations do not apply, as is shown by the three following examples:—

	Unit Machine	B.A.F. Machine	E.X.B. Machine
Material	49% ..	53% ..	55%
Labour	25% ..	21% ..	19%
Factory Expenses ..	26% ..	26% ..	26%

And the allocation of Factory Expenses remains a constant factor in cost.

There is a considerable variation in the factor when the two systems mentioned above are compared, as for instance:—

Factory Expenses Allocated	On Prime Cost	On Labour only	
A.N.O. ..	24/- ..	23/2	Factory Expense
C.A.E. ..	20/1 ..	7/5	,,
D.A.E. ..	18/4 ..	12/7	,,
F.A.N. ..	6/4 ..	8/5	,,

The true purpose of the allocation of oncost, however, appears to be lost sight of in both methods, which is the placing of a loading on prime cost which shall at the end of the period equalise with the actual expenses incurred. It will be seen by reference to p. 28 that in the allocation of Factory Expenses by the Unit System this object is achieved, and excessive fluctuation in the factory earnings, due to the variation in the character of the output, is practically non-existent.

It will be seen, further, when the development of the Unit System is followed out in the chapter on "Periodical Returns," that the comparison on the production value loading for oncost can be readily compared with the actual expenditure under this head, and that the manufacturing details afford the particulars for this comparison weekly or periodically.

Indirect Expenses—Pattern Shop Expenses.—

It will be noticed that the expense of the Pattern Shop as well as the Drawing Office is included in the Establishment Charges, and that no attempt is made to apportion these expenses to the particular machine or jobs.

In some works where specific machines are built, it is customary to include in the cost estimate a proportion of the Drawing Office charges, also patterns.

In the case of our illustration, however, the work of the Drawing Office, to a considerable extent, consists in supervision and overlooking, and a further considerable part in the constant endeavour to improve on the designs and economise on the production.

It follows, therefore, that the whole of this expense is treated as an establishment charge, and each machine carries with it a proportion of the expense, in the addition to factory charges per unit.

Equipment Cost.—

The question of Interest on Plant as an item in the cost estimate is one on which varying opinions are held, mostly theoretical, and no provision has been made in the costing for this item.

The book value of the plant in this business is £10,400, so that the annual charge of 5 per cent. per annum would be £520,

and if this were included in the cost estimate it would give us, say, 3s. per unit.

If, however, we take an extreme case of two businesses engaged in the same line of products, and having an equal output, one equipped with the most modern plant and labour-saving appliances, and the other dependent on hand labour, we shall naturally look for a considerable difference in the wages cost, both direct and indirect.

Assuming, further, that this was actually realised, we should have two costs for the same article, differing greatly in amount; and if selling prices were actually fixed on cost without reference to market values, we might find the item of Equipment Cost work out unfortunately for the better equipped factory in comparison. The reduction of the cost of production is the approved argument for the introduction of labour-saving machinery, and in the most modern systems of factory accounting a charge is laid down in the cost estimate for equipment. The custom generally, however, is to look for the return on the capital expended under this head in the increased balance of profit from the factory, and to omit any provision for the interest charges under this head.

In our illustration, however, where the efficiency of the factory management is shown by the working of the credit to the Manufacturing Account at cost, some charge should be made in respect of any increase of this item, otherwise the true efficiency of the operating would not be disclosed.

In the case of some continental factories the accounts are debited with the interest on the capital employed therein; and if we are to admit that where the factory freehold is held by the firm operating, a rent-charge should be created, the same argument applies with even greater force to the charge on the plant.

We may even carry this a stage further, and also charge to the factory, interest on the stocks of raw material on the same basis, for whatever advantage accrues to the factory from the employment of extra capital the cost of same should appear as a charge against its efficiency.

It may appear that this is carrying the matter to a fine point, but if we consider that if the factory is held responsible for the interest provision on extra capital employed therein, whether it be in factory equipment or in holding of stock, or of the advantageous purchase of material on special terms, we are enabled to judge by the results in such case, whereas the effect in the enhancement of profit is, or may be, swallowed up by the operations of the Sales or Trading Departments.

The tendency of modern times to combinations, and of bringing under one management a number of factories, renders some method of appraising results from the individual factories in the light of their equipment a matter of necessity, and there is no sound reason why methods which are advantageous in the plural should not be so in the singular.

Indirect Charges Trading Department.—

In the case of a large merchant firm having several branches it is customary to charge the branches with interest on capital employed by them on the same basis as between the Head Office and branches of a banking establishment, and in the case of the agencies of the business illustrated this principle is adopted. In this case, however, the entries form no part of the ordinary bookkeeping, but are memorandum entries only for the information of headquarters.

Not only is the collection of book debts accelerated by this method, but the stocks are kept well in hand, and the general management is made more efficient.

CHAPTER VIII.

STOCK.

ORDERS for material emanate in the first instance from the Works Office, which issues an order for the goods in triplicate. One copy is sent by post, one copy goes to the Counting House, and the third copy is filed under its own machine file.

The copy sent to the Counting House is retained until receipt of the invoice for the goods, to which it is attached, and the order form contains at the foot the unit standard cost and space for the actual unit cost. In the Works Office the system of filing is in all cases organised to the headings of different machines, as A.E.D., A.N.O., &c.

The goods when received are delivered to the storekeeper, who checks over the goods and issues a Goods Received Ticket specifying the particulars. This is in the shape of a card, and constitutes the record for an entry in the Machine Shop Stock Book, after which it is filed in the card cabinet under its machine heading. Separate cards are issued in the case of each machine letter, and the colour of the cards varies in each shop stock.

In this case the Machine Shop stock is white, Erecting Shop stock pink, and Paint Shop stock blue, while the Repairs Shop is buff.

The ruling of the Stock Received Book is as follows:—

MACHINE SHOP.—STOCK RECEIVED BOOK.

Week, January 24th 1905.

Card	Total	A.E.D.	A.T.F.	A.F.F.	A.N.O.	B.A.F.	B.A.E.	B.F.A.	B.N.E	C.A.E.	C.E.F.	C.O.T.	&c.
24	1·870	1·870											
25	1·320	..	1·320										
26	1·780	..	..	..	1·780								
27	2·324	..	..	..	..	..	..	2·324					
28	·926	·926											
29	3·483	..	3·483										
30	7·482	..	..	..	..	7·482							
	19·185	2·796	4·803	√	1·780	7·482	√	2·324					

COST JOURNAL.

Machine Shop Stock	19·185	
Dr. to		
Machine Shop Purchases		19·185

The balance of the Machine Shop Purchases Account gives the goods in transit at any time, the entry against this being the debit from the Purchase Day Book in units, which gives the total for the week as 26·485 units, or a balance of goods not delivered on invoices received of 7·300 units.

The credit to Machine Shop Stock Account is obtained by the issue of the Erecting Shop storekeeper's ticket, giving particulars of finished parts handed over. This is a card which, after entry in the Erecting Shop Stock Book, is filed away in the card cabinet under its particular machine initial.

The Erecting Shop Stock Book is identical with that of the Machine Shop Stock Book as regards ruling.

The Machine Shop and Erecting Shop storekeepers each issue at the end of every week a Stock List, showing the parts of machines in stock under each initial, and giving the number of each part.

This is a printed list for each machine, so that the labour is not very great, and is as follows:—

MACHINE SHOP STOCK CARD. No.

Stock Card. Week ending 1904. B.D.B.

No.		Unit	Units	No.		Unit	Units
20	Cams	22	440	10	Blocks	5	4·160 50
30	Brackets	14	420	20	Wheels	10	200
50	Shafts	38	1·900	30	Pulleys	20	500
70	Collars	8	560	20	Handles	8	160
40	Discs	11	440	100	Studs	1	100
80	Springs	5	400		Total	..	5·170
			4·160				

The cards are entered on a Summary Sheet, and added up, and the totals thus give the machine units in stock at the end of each week, and should agree with the balance of the Machine Shop Stock Account in units.

We have now got the records of the Machine Shop as follows:—

1 Card of stock received in raw castings or forgings.

2 Card of finished stock sent in to Erecting Shop stock.

3 Stock Card of Machine Shop stock in hand.

And these are collected in the Stock Received Book and the Delivery Book under each machine number, and the Works Office Summary is as follows:—

MACHINE SHOP WEEKLY SUMMARY.

	Stock Units	1 In Units	2 Out Units	3 Stock Units
A.E.D.	3·170	2·796	1·280	4·666
A.T.F.	11·405	4·803	2·324	13·884
A.F.F.	9·602	—	—	9·602
A.N.O.	10·318	1·780	4·263	7·835
B.A.F.	6·172	7·482	2·148	11·506
B.A.E.	8·843	—	—	8·843
B.F.A.	7·620	2·324	2·120	7·820
Others	239·880	—	69·922	145·223
	297·000	19·185	82·057	209·383
Work in progress				24·745
Machine Shop Purchases		7·300		
		26·485		234·128

The balance of 24·745 units in the stock at the end is represented by the parts unfinished at the end of the week, and this is checked at intervals by having in all the Job Tickets held by the men, which thus provides an easy method of checking this item.

In the chapter on Wages it will be noticed that the men can send in part of the work if the whole is unfinished, and as they are only paid on completed work it works out in actual practice that the jobs given out are practically completed, and only in rare instances are materials left unfinished.

The same system applies in the case of the Erecting Shop, Paint Shop, and Warehouses, which each return cards of work handed in, and also a summary of stock in hand.

In the case of the Erecting Shop, the Stores are so arranged that Machine Shop stock is on the right-hand side and fittings on the left side, and the Stock Return is made in two lists showing each department.

In the Paint Shop stock are only completed machines, ready for painting and finishing.

CHAPTER IX.

DEPARTMENTAL UNITS.

It would be quite possible to stop at this juncture, and to give the Weekly Summary of the operations in total, but, as will be seen from the organisation of the Works, any Weekly Summary which did not deal with the work in progress would not give sufficiently reliable results for comparison, and, in particular, businesses of the nature of those specified do, at some period of the year create the entire output of the factory in parts ready for seasonal demands.

The provision of the departmental units has already been provided for by the division of the Purchases, Wages, and Stock Returns, and there yet remains to be dealt with in this respect the allocation of oncost to the different departments.

It will have been noticed perhaps that in the Stock Returns the finished goods from one department to another are carried forward at the material unit figure, and do not carry Wages or Oncost into the Stock Accounts; and in dealing with the raw material for checking purposes this method is to be adhered to.

In the case of Direct Wages, the division of the wages into departments is automatically carried out by the provision of separate Wages Books, and each Wages Book gives for

its direct labour its true equivalent in productive value for the wages paid.

Departmental Oncost.—

Considerable divergence of opinion exists as to the proper method of the division of the Factory Expenses into Departmental Cost, and as to the point at which allocation should stop.

With regard to some part of the expenses, there is room for diversity of opinion, but inasmuch as the one thing needful is the provision in such allocation for the balancing of the estimated cost with the actual expenditure, so long as this is carried out any discrepancies between departments do not affect the total.

It may be mentioned here that in designing a system of cost such system should in all cases work from the Manufacturing Account instead of from the shop cost.

With regard to the division of the expenses, some of these are readily allocated, others are estimated, and others are treated as general charges. The following items are treated as general charges:—

Insurances on Stocks and Rent, Rates, &c., on Warehouses.

Maintenance of Works and Buildings.

Drawing Office Salaries, Patterns, and Models.

Warehousemen and Carters.

Wages for Electric Light.

Obsolescence Charges on Plant.

Works Manager and other Salaries.

Packages.

Of the total cost of £6,215 12s. 6d. Factory Expenses, the above amount to £1,997 13s. 7d., leaving allocation as follows:—

	£	s	d
Machine Shop	2,663	7	3
Erecting Shop and Paint Shop	837	1	0
	717	10	8
General	1,997	13	7
	£6,215	12	6

In this allocation to departments the repairs are charged as actually made, and depreciation is divided on the actual plant. Storekeepers' are actual, and timekeepers' and Works Office expenses are divided *pro ratâ* on the wages in each department. Coal and Power Charges are estimated on the horse-power taken by each department. No good purpose would, we think, be served by attempting to lay down any general principle for this allocation; the division made above will serve as a general guide.

The next step is the allocation of the oncost on the unit basis, so that in taking the production of each department the equation may be comparable with the actual expenses incurred, and this is comparatively simple.

It will be remembered in our chapter on "Indirect Expenses," and on the calculation of the production value for the Manufacturing Account, the estimate of the indirect cost on 3,500 units of A.E.D. machine works out to practically the figure required, and although the actual machines made were 8,250, of varying costs and factors, the results worked out true.

The Factory Expenses, therefore, are equal to 35s. 6d. per unit, and if we take the division specified above we have this figure divided as follows:—

	£	s	d	Equal to
Machine Shop Expenses ..	2,663	7	3	15·21
Erecting Shop Expenses ..	837	1	0	4·79
Paint Shop Expenses	717	10	8	4·10
General Charges	1,997	13	8	11·40
	£6,215	12	6	35·50

It would be possible, therefore, to take these figures on the weekly unit production of each department, add each specific shop expenses and a percentage for the general expenses for this loading, and if the output were unvarying in character this would suffice. As, however, the output in each machine varies, and as the selling price of each is inevitably based on its cost, it will be seen that to do this would be to stultify the advantages of the Unit System, and to degrade it to the same place as the method of averaging at, say, 25 per cent. on prime cost.

The method to be adopted is therefore, in the first place, to find the Machine Shop prime cost, and by a proportion sum to allocate the Factory Expenses as a whole on this figure, as:—

	Total Prime Cost	Machine Shop Prime Cost	Total Oncost	Machine Shop Oncost
A.E.D. Machine	·739	·458	·260	·161
D.A.G. do.	·338	·169	·117	·058

And so with the other items, and by this means we are enabled to get the actual estimated oncost to be allowed to each department on its output, based on the actual production value of the output calculated for each machine.

This figure includes everything but direct labour and material cost.

Departmental Accounts Weekly Summary.—

The Weekly Summary issued for each department compiled from these figures, and bringing into account the wages from the particulars provided by the Wages Books, is as follows:—

Output.—

MACHINE SHOP SUMMARY.

Week ending February 24th 1904.

OUTPUT.

	Total Units	Material Units	Wages Units	Oncost Units
Total to last week	253·424	134·833	51·220	67·371
Current week	38·526	20·629	7·874	10·023
	291·950	155·462	59·094	77·394
Standard units for period ..	346·640	177·520	78·960	90·160
Decrease on standard ..	54·690	22·058	19·866	12·766

WAGES SUMMARY.

	Production Units	Cash Units
Total to last week	51·220	51·606
Current week	7·872	7·980
	59·092	59·586
Loss on wages on unit	·494	
	59·586	59·586

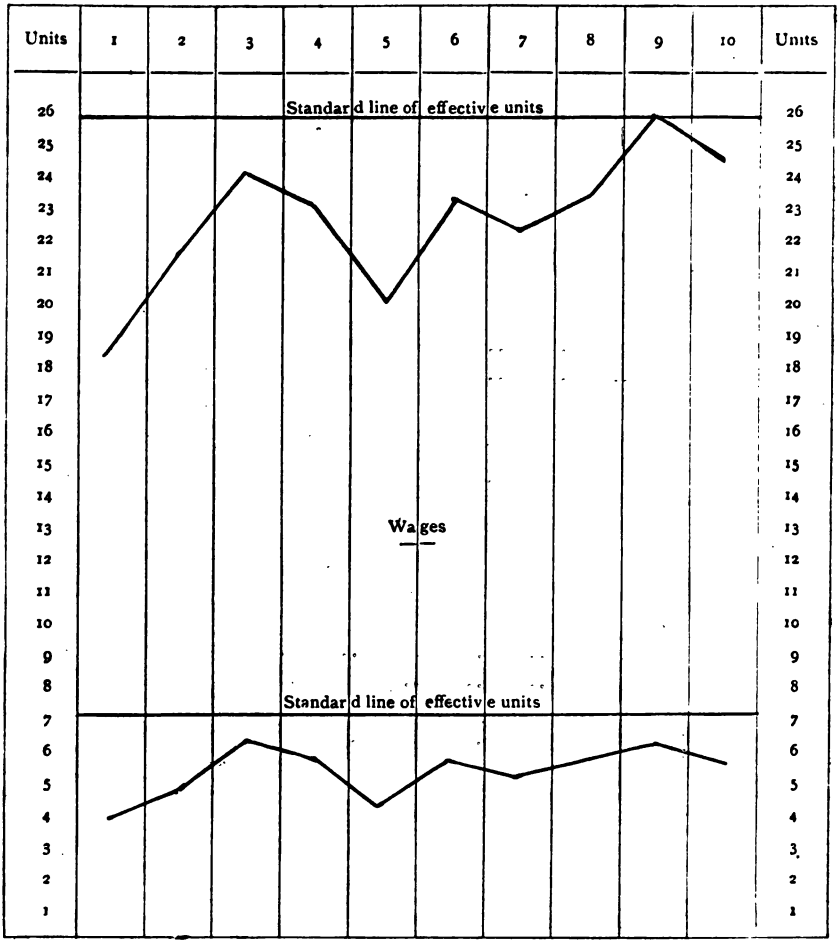
SHOP STOCK UNITS.

	Units
Total inwards to shop	164·232
Outwards, as above	155·462
Work in progress	8·770

Multiple Costs. UNITS

MACHINE-SHOP OUTPUT SUMMARY

Ten weeks ending March .... 1904.



ERECTING SHOP AND PAINT SHOP WEEKLY SUMMARY.

Week ending.....1904.

OUTPUT.

	Machine Shop Stock Units	Erecting Shop Stock Units	Wages Units	Oncost Units
Total to last week	120·228	94·186	30·58	38·14
Current week	14·348	14·328	5·79	5·34
	134·576	108·514	36·37	43·48
Standard units	140·122	116·428	45·19	48·12
Decrease on standard ..	5·546	7·914	8·82	4·64

WAGES RETURN.

	Production Units	Cash Units
Total to last week	30·58	31·24
Current week	5·79	6·10
	36·37	37·34
Loss on units	·97	
	37·34	37·34

SHOP STOCK UNITS.

	Machine Shop	Erecting Shop
Total inwards	155·462	135·265
Total outwards	134·576	108·514
Balance	20·886	26·751
Stock at commencement	198·224	168·127
Stock at date	219·110	194·878

Notes on Machine Shop Weekly Summary.—

This return shows that the actual output of the shop is short on the period by 54·690 units, of which 22·058 represents material and 19·866 wages not paid. This shortage in output is equal to a loss on the earnings towards the oncost for the period of 12·766 units, equal in sterling to £91 3s. 5d.

It is to be understood by this that either the work has not been got through the shop, or the shop has been engaged on the less remunerative output in the lower priced machines. On reference to the Production Account (p. 28) it will be seen that, owing to the variable nature of the output, it is possible to produce a greater number of machines than the average of 165 per week, and yet not make the necessary effective units of production to carry the required proportion of factory expenses and profit.

The wages show the actual productive units created by the labour as against the value in units for the cash paid, and therefore *the loss is not owing to leakage in wages in this department*, but evidently due to less remunerative orders which the factory is engaged on, and consequently due to the character of the output.

Notes on Erecting Shop Weekly Summary.—

The Erecting Shop Stores is the warehouse for all finished parts, and the actual output being dependent on the orders for Warehouse, this shop output is subject to some fluctuation at various periods of the year, and meanwhile the stock accumulates in parts waiting orders.

The Stock Returns show, however, the exact disposition of the stock, and each pigeon-hole in the stock room being labelled, and a card attached showing stock in hand, these returns are readily compiled by the stockkeeper. The wages inducement gives a rapid influx of parts on Thursdays (wages made up to Thursday night), and an outflow of parts on Fridays and Saturdays, the stock being taken early on Monday. The return shows a satisfactory clearance of stocks which have only increased 20·886 units since stocktaking in Machine Shop parts, while the movement in fittings provides a means of check against the Purchase Return Summary.

CHAPTER X.

PERIODICAL RETURNS.

It is not, perhaps, over-stating the matter to describe this chapter as the most important in the book. While in the foregoing chapters the machinery has been created for the purpose of securing the records of the manufacturing operations, it is to the focussing and expression of these records in a concise and summarised form, in the shape of periodical returns, that the utility of the machinery is apparent. It is not too much to say that only by the effective periodical presentment of interim results is any system of Cost Accounts to be fairly judged.

The provision for the analysis and dissection of the consumption of raw materials, and the allocation of expenditure is essentially necessary, if only for the purpose of presenting the annual accounts in a form upon which comparisons can be usefully made, but the bringing forward of these results on a periodical basis constitutes the chief *raison d'être* of costing as now understood, both for the purposes of the factory management and also for the purpose of the control of the business by directors and partners.

Following out the method adopted in presenting this exposition of the Unit System, we have to ask ourselves what, in the first place, is the character of the information likely to be of practical benefit to a director? Secondly, what is the information required by the trading management as to the operations

of the business? And thirdly, what is required by the factory manager?

This may seem to be a reversal of the usual order of importance; but if we consider that the first duty of a business is to earn profits on its capital, secondly to maintain and improve its goodwill or connection, and thirdly to carry on its operations on the most effective and economic basis of manufacture, our conclusions are sustained, and we shall find our procedure justified.

It is important that the preparation of a Weekly Return shall involve a minimum of clerical labour, or otherwise attention will be diverted to this, which is elsewhere required in the interests of the business.

The first matter for consideration is that as the results of the annual accounts are summarised in the profit or earnings, so the Weekly Return shall give some indication as the periods are taken of the building up of the annual profit required for dividends on capital, and this is dependent, in the first place, on turnover, or sales output.

TRADING EXPENSES RETURN.

	Last Week	Current Week	Total to Date	Standard
	Units	Units	Units	
Travelling Expenses.. ..	3·32	3·18	3·28	3·42
Advertising	5·50	5·00	5·49	5·58
Agency Expenses	16·12	17·04	16·32	17·03
Rent, Rates and Taxes ..	2·22	2·48	2·32	2·98
Salaries	6·24	6·49	6·35	6·86
Carriage and Freights ..	8·70	9·24	8·82	9·85
Sundries	5·28	5·18	5·24	7·95
	47·38	48·61	47·82	55·67

By the conversion of the sales output into units it becomes possible to take the expenses on the percentage to the unit, and thus to gauge this with last year's expenses as a comparison.

SALES RETURN for week ending July 28th 1905.

	Total to last week	Current week	Total
HOME SALES :	Units	Units	Units
London	793	27	820
Liverpool	493	17	510
Glasgow	454	16	470
	1,740	60	1,800
AVERAGE PRICES PER UNIT TO DATE :	£ s d	£ s d	£ s d
London	10 2 6	10 3 4	10 2 8
Liverpool	10 7 6	10 5 0	10 7 3
Glasgow	10 2 0	10 1 0	10 2 0
Average Home prices ..	£10 5 0	10 4 0	10 3 9
EXPORT :	Units	Units	Units
U.S.A.	280	10	290
Continental	156	18	174
	436	28	464
AVERAGE PRICES :	£ s d	£ s d	£ s d
U.S.A.	8 12 6	8 15 0	8 13 4
Continental	8 5 0	8 10 0	8 6 3
TOTALS :			
Home and Export	2,176	88	2,264
Average Price	£9 10s.	£9 11 3d.	£9 10s. 6d

Notes on Sales Return.—

The principle of the units is carried into the Sales Returns, in that the sales are carried into units of the A.E.D. machine, and measured by that unit as to effective sale profits.

By working all the sales out on the conversion of the units the averages give the desired information, and show how the trading to date provides the necessary profits.

FACTORY RETURN for week ending.....1904.

PRODUCTION ACCOUNT :	Last week Units	Current Units	Total Units
Machine Shop	582·428	21·728	604·156
Erecting Shop	1082·192	43·229	1125·421
Paint Shop	264·121	8·164	272·285
Total ..	1928·741	73·121	2001·862

WAGES DIRECT :	Last week	Current	Total
Machine	7·424	7·512	7·442
Erecting	4 431	4·464	4·439
Painting	2·008	2·021	2·010
	13·863	14·097	13·891
Factory Expenses	33/9	34/-	33/10

PURCHASE RETURN :			
Machine Shop	642·410	26·022	668·432
Erecting Shop	1213·284	54·182	1267·466
Paint Shop	102·134	5·231	107·365
	1957·828	85·435	2043·263
Purchase Units	— 43·126	+ 2·128	— 40·998

— Units represent Savings in invoice prices of goods.
+ Units represent Losses in invoice prices of goods.

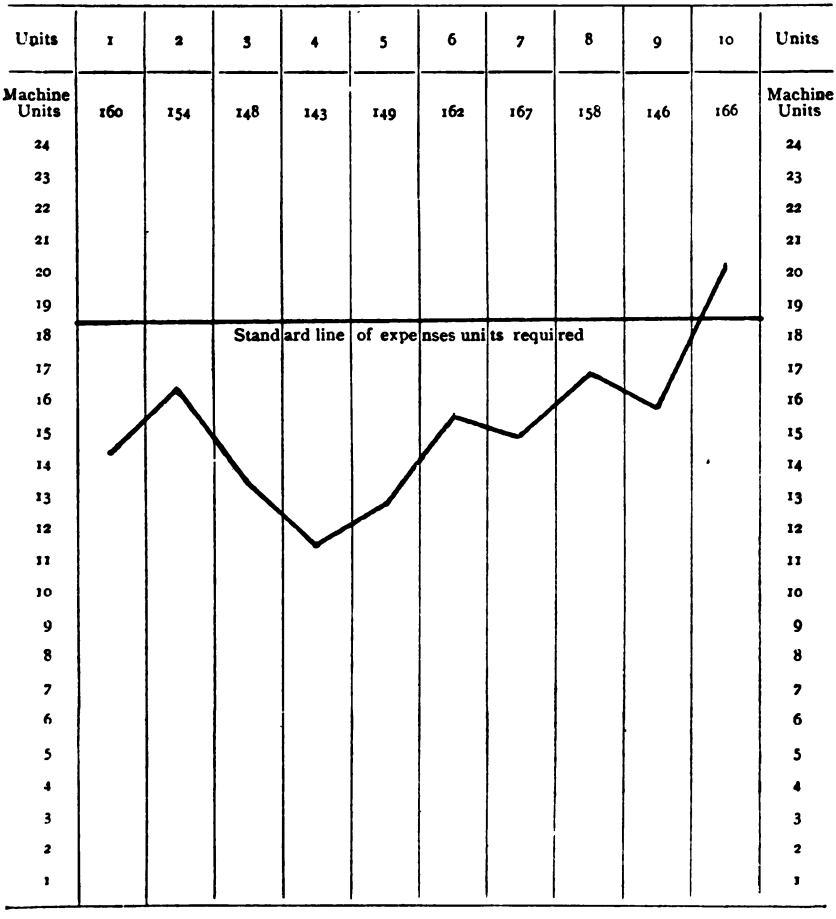
Notes on Factory Returns.—

Here is set out the production in units, the cost of direct labour per unit, and the aggregate of the *actual* expenditure to the unit of production, the last against the provision of 35s. 6d. per unit. The Purchase Return shows that the inwards are keeping pace with the out-turn, and at this season (July) of the year this is what is required. The purchase units figure shows the savings on the raw materials to date—viz., say 41 units, ubout £292 on the prices allowed for in the costing.

Diagram No. 2.

DIAGRAM showing Comparative Efficiency of Weekly Production in Effective Units of Output—Expenses Units provided.

For 10 weeks ending March .... 1904.



See Machine Shop and Erecting Shop Weekly Summaries, pp. 57 and 60

The further returns required by the director is that of the Stock Returns, and are given in whole numbers only.

STOCK RETURNS.

UNITS IN CLASSES OF MACHINE.

FACTORY :	A	B	C	D	E	F	Total
Machine Shop	14	18	28	40	40	69	209
Erecting Shop	22	16	52	62	128	140	420
Paint Shop	4	10	16	20	14	18	82
Warehouse	2	6	4	14	16	22	64
Total Factory	42	50	100	136	198	249	775
SALES :							
London	20	10	4	16	12	20	82
Liverpool	2	14	10	12	8	16	62
Glasgow	4	6	8	22	18	24	82
Others	1	2	1	3	5	8	20
	27	32	23	53	43	68	246
Total	69	82	123	189	241	317	1021

It may be asked what advantage is gained by converting a Stock Return into units, to which the answer is that the stock in the factory represents a great number of parts in progress, and not completed machines, and to express these in units gives a comprehensive view of the whole stock arrangements and production coming forward obtainable by no other known method in so compact a form.

This completes the returns furnished to the board, and we now turn to the Trading Department and its management.

TRADING DEPARTMENT RETURN.
SALES RETURN.—Totals to Week.

	A	B	C	D	E	F	Total	Remarks
London	120	126	109	221	180	64	820	Additional number wanted.
Liverpool ..	42	48	63	109	129	119	510	Factory late delivering these.
Glasgow	10	22	31	43	68	296	470	Consignment on way.
U.S.A.	120	149	21	..	..	..	290	Orders not executed, 20 A.T.F.
Continental ..	..	..	..	52	68	54	174	Ditto in hand, 20 E.X.B.
	292	345	224	425	445	533	2,264	
Orders to Factory in hand ..	50	42	65	100	140	200	597	

NOTE.—Average is lowered on special sale to Roberts, Edmonds & Co., of 40 C.A.E. Machines at special price for export to Brazil.

For convenience the returns are given in classes rather than under each machine designation, as the whole of the classes are not equally favoured, and it is easy to see by reference which machine is running up the class figures.

The Expenses Return and the Stock Returns give to the trading manager a sufficient grasp of the movements of the business to put him on the alert for inquiry.

We now deal with the third and last section of information for the factory.

MACHINE RETURN for Week ending.....1904.
FACTORY RETURN.

Machine	Machine Stock	Paint Stock	E.S. Stock	Machine Stock	Purchases on Order	Sales Orders	Machine Shop Orders	E.S. Orders	Paint Shop Orders	London Stock
A.E D.	1	1	6	4	10	10	10	4	2	10
A.T.F.	..	1	4	2	20	12	6	2	2	6
A.F.F.	..	2	2	4	10	14	2	2	4	4
A.N.O.	1	..	4	2	10	14	..	..	..	..
B.A.E.	2	6	4	4	20	10	10	4	2	4
&c.										
&c.										
	64	82	420	209	120	597	120	86	62	82

The above figures represent machine units, not the numbers of each machine.

It is the duty of the Works Office, in making up the Weekly Stock Summaries, and one of the chief reasons why these were instituted, to see that the stock of parts is maintained at its proper proportion of each. It would be useless having in stock a number of parts of one machine without the corresponding parts finished and ready, and therefore the units in the Stock Lists practically represent the necessary parts for the completion of the machines of that designation.

Wages.—

It is the duty of the Works manager to sign the Wages Books weekly before payment. Therefore there is no need for compiling special returns for this purpose.

FACTORY EXPENSES RETURN.

Last Year		Total to Last Week	Current Week	Total	Unit Charge
	Wages—direct .. .				
	Do. —indirect ..				
	Salaries and Foremen..				
	Coal and Power A/c. ..				
	Repairs—Buildings ..				
	Drawing Office.. ..				
	Works Office				
	Patterns and Models ..				
	Incidental Expenses ..				
	Rent, Rates, and Taxes				

In addition to the returns here provided the Works office furnishes the Works manager with the Stock Lists, and the Job Cards noted and the costs worked out as in the Wages Ticket specified in the Time labour section, and the information disclosed by the cards is continually in evidence for the purpose of cheapening the production.

Another return made monthly by the Works office is the Schedule B, giving the comparison in units of the whole range of machines made, on which any variations in the factors are noted in red ink for reference.

Profit Units.—

If we follow on with the profit unit as our basis we can, by the analysis of our Day Book, see exactly what our turnover is doing towards finding the required margins for expenses and profit.

For instance, the A.E.D. machine at a cost of 142s. 10d., and a selling price assumed at £12 10s. gives a margin of £5 7s. 2d. gross profit, and we can then take this figure of £5 7s. 2d. as our basis, and show a comparison with the other items of our schedule as follows:—

TABLE C.

Machine.	Sale Unit.	Factory Unit.	Profit Unit.	Class Average.
A.E.D.	1·000	1·000	1·000	1·112
A.T.F.	1·000	·852	1·197	
A.F.F.	·920	·748	1·149	
A.N.O.	·840	·644	1·100	
B.A.F.	·840	·663	1·076	·854
B.A.E.	·760	·615	·952	
B.F.A.	·680	·615	·767	
B.N.E.	·600	·587	·617	
C.A.E.	·720	·539	·950	·649
C.E.F.	·600	·520	·706	
C.O.F.	·500	·539	·447	
C.X.A.	·460	·435	·493	
D.A.B.	·600	·559	·655	·476
D.A.E.	·520	·492	·557	
D.A.G.	·440	·454	·422	
D.E.F.	·360	·435	·259	
E.X.B.	·360	·378	·335	·234
E.A.F.	·280	·312	·237	
E.B.X.	·260	·322	·177	
E.C.C.	·220	·246	·185	
F.A.B.	·320	·303	·343	·219
F.E.A.	·280	·312	·237	
F.C.C.	·200	·237	·151	
F.A.N.	·160	·170	·146	

Taking the profit units on the Sales Return these work out as follows:—

TABLE D.—SALES (Page 67).

	Machine Units.	Cash Units.	Profit Unit on Class Average.
A.	292	245 × 1·112	= 272·440
B.	345	298 × ·854	= 254·492
C.	224	204 × ·649	= 132·396
D.	425	410 × ·476	= 195·160
E.	445	386 × ·234	= 90·324
F.	533	507 × ·219	= 111·033
	2264	2050	1055·845

If greater accuracy is desired this table can be worked out on the basis of each machine sale, but for practical purposes the class average will give approximate results.

Notes.—

(*a*) The machine units represent quantity.

(*b*) The cash units represent the division of the sales value by the normal sale unit. Thus, if the normal sale unit was in the A class £12 10s., and the actual sale price averaged only £9·80, then the effective sale units would be reduced from 292 to 245 to compensate for the ineffective sale prices.

(*c*) The earnings of the output in sales margins is therefore 1055·845 units, which at £5 7s. 2d. per unit represents gross profit of £5,657 11s. 4d.

(*d*) If we now take the calculation back to our original basis we find that our standard on the last year will give us a comparison as follows:—

	£ s d	
Sale Expenses	2,362 4 8	Estimated to date.—For the
Agency Do.	2,980 10 6	period
Other Expenses	4,265 19 9	
Do.	123 1 4	
	9,731 16 3	
Profit	7,042 16 9	say $\frac{3\frac{1}{2}}{12}$ths
	£16,774 13 0	£4,892 12 2

Taking our standard basis of 70 units per week, we find that for the 15 weeks we have a total of 1,050 units, and our Sales Return is equal to 1,056 units.

Our final summary is therefore as follows:—

	Dr.	*Cr.*
MANUFACTURING ACCOUNT.—	Units.	Units.
Purchases (page 64).. ..	..	40·998
Wages (pages 57 and 60) ..	1·464	
Factory Expenses (do.) ..	17·406	
	18·870	40·998
Balance	22·128	

	Dr.	*Cr.*
	£ s d	£ s d
MANUFACTURING ACCOUNT.—*Sterling.*		
Factory Expenses	124 6 1	
Wages	10 9 1	
Purchases		292 15 10
Factory Expenses, Cash Credits		78 16 3
Balance	236 16 11	
	£371 12 1	£371 12 1

We have, therefore, to face the problem which exists in practically all industries, that what the Sales Department wants is not always that proportionate output which best suits the factory production. But for the fact that the Purchase Department was able to effect savings on the standard rates for raw materials of £292 15s. 10d., and the factory was able to effect savings in expenses of £78 16s. 3d., we should have in our Profit and Loss Account a debit on Factory Account as against the Sales Department profits of £765 9s. 2d. over standard.

It will be seen by the Unit System therefore that the effect of the fluctuations as between the manufacturing and the sales is clearly set out week by week, and that, in the event of these balances fluctuating adversely, their incidence on the general operations is capable of exact measurement. Instead of the savings in purchases being distributed over a great number of costings, in which their effect would have been obscured, we have the comparisons of the fluctuations in the elements of prime cost carried direct to our Final Summary, and the same in wages and factory charges.

We may further consider the problem of sales output as against selling prices in this connection. It will be seen on reference to Table D that, in order to obtain the required units of profit, the sale prices of all the classes have been reduced owing, in this case, to the selling of additional machines at lower prices, and to determine the limit at which this can be effected we are able to utilise the figures given us by the scale of profit units in Table C as our basis for operating. Taking the class average in each case as our basis, we can select those machines which will allow of the reduction being made, in which we are guided by the proportions between the factory and sale units, as, for instance, A.N.O., B.A.F., C.A.E., and which are more clearly shown in the diagram No. 4.

PROFIT AND LOSS ACCOUNT.

		Dr.			*Cr.*		
		£	s	d	£	s	d
Manufacturing Account					236	16	11
Trading Account ..	£5,657 11 4						
Less Basis	4,892 12 2						
					764	19	2
Trading Account Cash Credits ..		..	..	..	128	3	11
					£1,130	0	0

The comparison shows, therefore, a balance to the good as against last year's basis as above of £1,130 os. od. The cash credits represent the actual payments from the Nominal Ledger as compared with last year for the same periods, and represent decrease in the actual expenditure at this period, after providing for the accrued rents, rates, taxes, &c.

If we consider the form in which this information is given, and the methods by which it is obtained, it will be seen that there exists no other system which can with so small an amount of detail disclose to the management the position of the business at intermediate dates in the financial year.

CHAPTER XI.

SALES UNITS.

THERE is perhaps some little explanation needed in the fixing up of a unit for the Sales Account and Trading Department. In the first place, it may be premised that profit is the margin contained on the sale price over cost, and can only materialise when the actual transfer of the goods is consummated.

Upon the realisation of a sufficient number of margins in the sales depends the profits, which again fail to materialise until the expenses incidental to the transfer have been discharged. Now the realisation of margins does not possess any stable elements or factors, such as cling to the materialisation of the expenses side of the account, and, while the expenses need considerable skill in restraining their natural tendency to expand, the sales margins need continual care against contraction.

Moreover, the margin to be obtained varies in different classes of goods, and, as a rule, the higher the sale price the larger the margin representing gross profit. It follows, therefore, that to obtain from a fluctuating and variable factor a definite and specific residue with which to meet expenses and provide dividends, both of a fixed basis, a line of average must be maintained in which high margins must make up for small ones, or in which the number of small margins must be increased considerably to maintain and make up for any loss in high margins.

We come, therefore, to the consideration of the factor of the average required to produce the sum for expenses and profit, and as this comes to £8,000 per annum for profit, and £9,500 for expenses, on a total turnover of £44,000, this means an average of 40 per cent. profit.

To maintain this average, it is evident that if we happen to sell a number of articles with small margins we may get out the total output, but not reach the profit required, so we decide upon one of our best selling lines, and call this our unit article. Taking the profit we make on this, we calculate that we must sell, say, 4,000, of these to produce the required gross profit. Now we have a measure against which we can test our sales to see if they are coming up to the figures required. We take our full list of products and we take the proportion they bear to our unit article, and by a decimal we can say that if our next article is ·50 of the unit figure we shall, when we have sold two, have made a profit equal to one unit article, and so with the others; one may be ·25, another ·33, of the unit article, and so if we express our sales in terms of the unit article we shall know exactly what progress we are making.

We have calculated our expenses would be met by the sale of the 4,000 units, and we can, therefore, calculate each item of our expenses out on 4,000 units, and by doing so can see exactly on the one hand what we are making, and, on the other, what we are saving on our standard.

This sale unit need have no reference to the factory unit, but if it is possible to make the same unit serve both purposes it is of considerable advantage in comparing manufacturing and selling.

There are a number of industries in which a spurious unit is used with disappointing results. Take the case of a Lace Curtain manufacturer, who costs on the rack produced, and finds in

consequence that his expenses are not balanced by his margin between cost and selling price. In this case it is necessary to take one class of lace, and to calculate the proportion of so many racks of another kind of lace to equal it, owing to the difference in width or quality, or the probable output of the machine.

Hosiery and Boots are two other industries to which the same remarks apply, and if their schedule of costs were worked out on the Unit System, as in Table B, the comparison shown by the unit proportions would at once reveal the, at present, unrecognised leakage in profit.

In the case of a Furniture manufacturer it would be possible to unitise his sales into sideboards or bedroom suites, and to get his profit it might be necessary to count 120 chairs as a sideboard, if the latter were adopted as the unit. In that case his necessary turnover would be, say, 1,000 sideboards per annum, and this would be made up of drawing room suites, cabinets, and whatnots, but so long as these are expressed in units of a sideboard, and 1,000 sideboards will provide the wherewithal for profit and expenses, he would know week by week just how many sideboards, or other articles expressed as such, he had got sold towards the 1,000 required.

Then in the case of Travellers and Orders. The business done by a traveller should be unitised and expressed in units. As, for instance, according to the schedule a chair is ·025 of a sideboard, and the traveller books an order for 1,000 of these at a price which only works out as ·023. This is passed over, and again a lower price is taken. By adopting the Unit System it is possible to carry that man's transaction in your mind. Not only can you readily tell what amount of business is being done, but what it is either above or below the unit basis on which you have made your calculations.

CHAPTER XII.

FACTORY UNITS.

THE detailed argument under the chapter devoted to Production Account will have given particulars as to how the unit is arrived at in the special case here dealt with of an agricultural machine maker. The principles on which this selection is made are the same in the case of any of the special industries classified under this group, but the application of these principles may, perhaps, not be so clear to the reader who has in mind some other specific industry to which the Unit System appears to lend itself.

The arguments used in the chapter on "Sale Units," however, are applicable to this chapter, but inasmuch as the factory may be taken as the generating station for the production of the units, some further details may be of service.

In the first place, there must of necessity be prepared a full schedule of the costings, and this is to be grouped into divisions, in which the raw material and finished material purchased are clearly defined.

Wherever partly manufactured goods are used they should be departmentalised in the Purchase Summaries, and, broadly speaking, the divisions in the purchases should form the initial basis for the division of the accounts for departmental costs.

If, for instance, we have one or more raw materials, which in the first place go to one or more departments for initial

handling, these should find their places in the purchase classification and be allocated to Departmental Stock Accounts. Where further materials are purchased, which are consumed in following on departments, these should be separated and classified.

The schedule of costings should be made out in such a form as to agree with the classification of purchases, and should, moreover, show the fixed charges in a separate division. This schedule should show clearly the prime cost.

It will be an advantage, in the first place, to prepare the schedule in total, so as to avoid departmental analysis if possible, and to thus obtain a definite total prime cost for the allocation of the fixed charges. In all cases let the analysis proceed from the totals, and not the totals from the analysis.

In the case of departments strictly self-contained, and which receive and finish their raw material complete for market, no difficulty arises in the specific charges, but only on the proportion of the general charges. In such a case the Material, Wages, Production, &c., form in themselves a separate Manufacturing Account, and may be treated as such, or else be separately headed in the General Manufacturing Account, or brought into credit as a balance only.

In some cases there is a considerable business done in repairs and sale of parts of machines.

In this case the Stock Accounts of the other departments will furnish the debits to this department for parts, and it will be found an advantage to separate the Repairs Departments entirely from the ordinary shop, so as to show the earnings of this branch. The only difficulty arises in the wages, since the Repair Shop may require additional assistance for short periods, but in this case the transfer of hands, say from the Erecting Shop to the Repair

Shop, is no greater difficulty than the setting on of fresh hands. In the case in point some men draw their wages in all three shop books, and for all paying purposes are treated as though they were different individuals.

The fundamental value of the factory unit is the standard of measurement, and its only practical value.

A Brewery is measured in effective units by the barrel capacity. A Colliery by the tons of coal raised, and a Mine by the tonnage output, and in these cases the unit expressed covers some differences in values, although the operating costs are identical, or may be practically so.

In the case of multiple costs, however, the output is of a fluctuating character; but, as will be seen by the foregoing chapters, the effect of the fluctuation in character of output may be most marked in its effect on the elements of prime cost without disturbing the margin for expenses.

Average Unit.—

It might appear that, having regard to the character of the output, and the range of costings being spread over so wide an area, the adoption of an average unit would give better results than the taking of the highest prime cost article as a basis unit.

In actual practice, however, it will be found that the expression of the unit as an average lowers the basis for the allocation of the indirect charges, and does not give a true divisor.

If an average unit were adopted it would not give an absolute divisor in the factory expenses, because the average would fluctuate considerably month by month, and until the year was completed the true average could not be ascertained, whereas by the adoption of the highest prime cost machine the divisor is absolute, and the efficiency of the production is readily comparable.

It follows, therefore, that in dealing with a fluctuating factor a true comparison can only be made with a fixed ratio, and that a fluctuating factor and a fluctuating ratio cannot compare.

Composite Unit.—

The same reasoning applies equally to a composite unit. In this case a leading article in each class of products may be taken, and the average of these fixed as a unit. Here, again, the average destroys the comparison, being fluctuating factors in comparison.

In the case of some businesses, however, in which parts only are produced, it is possible to take a composite unit, made up of parts from each shop; but this is arrived at by an aggregation of parts to a unit whole, and the same purpose would be fulfilled by the working of each department on its own unit basis. We might assume, for instance, that in a boot factory gents, ladies, shoes, slippers, formed separate and distinct shops or departments, and that materials and all prime cost elements were separate and distinct. In this case the departmental costs would be, practically, single cost workings, and the allowance of factory expenses made on relative output. Even then the output of each department would be a fluctuating one, and would be preferably dealt with on a unit basis, as by no other means could its output be measured in short periods.

The true composite unit, however, would be applicable in the case of a business making principal and by-products. We may take the case of a miller, who out of one article, wheat (blended, of course), produces a number of products varying in character. Here the unit would be made up of—

	Standard	Actual
Supers.	·420	·380
Fines	·380	·260
Commons	·160	·260
Offal	·040	·060
	—— 1,000	—— ·960

(quantity) × (factor = quality) = composite unit.

The proportions would give a unit output which would fluctuate in total, showing loss in efficiency on this standard. In this case 1,000 would represent a composite factor unit.

It is, of course, impossible in the space of this book to deal with all the difficulties to be overcome in the setting up of the "Unit Standard." The examples given will show how this is to be worked out, and the advantages are too obvious not to merit an earnest effort to secure them.

Above all, it is to be noted that while in the commercial books accuracy is indispensable, in that these deal with interests other than that of the factory, and directly conflicting, in the case of the factory costs what is required is the information which will grip the attention of the factory manager, and point him to the fluctuation which robs his margin of profit by increasing his cost, or by leakage allows his margin to disappear.

Diagram Units.—

The efficiency of diagrams in the service of the factory office is considerably increased by the adoption of the Unit System of costing. The varying factors are by this means condensed and co-ordinated, so that expression in diagrams becomes articulate and emphatic.

Sale Units and Factory Units.—

For the purpose of finding our ideal output we may take the unit table shown on p. 82, and by summarising this we shall find that our schedule provides for a discrimination in selling lines as follows:—

A.T.F.
A.N.O.
B.A.F.
C.A.E.

Are our best selling lines, as their proportion of Factory Cost to the A.E.D. machine is below their proportion of selling price to the A.E.D. machine.

For instance, the factory cost unit of the A.N.O. machine is ·644 of A.E.D. machine, and if we compare this with the selling

price of the A.E.D. machine its sale unit is ·840, showing a gain on its sale unit.

A.F.F. compares as ·748 Factory Unit to ·920 Sale Unit.
B.A.F. Do. ·663 Do. ·840 Do.
C.A.E. Do. ·539 Do. ·720 Do.

while in the case of the B.N.E. machine, which is a keenly cut line, the comparison is

B.N.E. Factory Unit ·587 Sale Unit ·600

The comparison thus obtained by placing the sale unit value as against the factory cost unit is of considerable advantage in the direction of the sale output, and emphasises the necessity of making the sale unit and the factory unit on the same basis.

The full comparison of the schedule is as follows:—

TABLE E.

	Sale Unit.	Factory Unit.
A.T.F.	1·000	·852
A.F.F.	·920	·748
A.N.O.	·840	·644
B.A.F.	·840	·663
B.A.E.	·760	·615
B.F.A.	·680	·615
B.N.E.	·600	·587
C.A.E.	·720	·539
C.E.F.	·600	·520
C.O.T.	·500	·539
C.X.A.	·460	·435
D.A.B.	·600	·559
D.A.E.	·520	·492
D.A.G.	·440	·454
D.E.F.	·360	·435
E.X.B.	·360	·378
E.A.F.	·280	·312
E.B.X.	·260	·322
E.C.C.	·220	·246
F.A.B.	·320	·303
F.E.A.	·280	·312
F.C.C.	·200	·237
F.A.N.	·160	·170

It will be seen, therefore, that the margin of profit obtained towards the sale expenses and dividends varies

considerably in the different machines, as would be expected, and that in fixing on the standard of sale units required a much greater output is needed on the lower-priced machines to bring up the required aggregate of margins.

Factory Output.—

The adoption of the Unit System as the basis of calculation for output and the apportionment of expenses is of considerable advantage in determining the effective profitable output, and in focussing the effect on the profits of any forward movement therein. It also enables the management, by the adoption of comparative diagrams, to balance the variations of the Sales and the Manufacturing Departments.

If we take the Table D figures and Table E together, we may institute comparisons which will illustrate this point.

TABLE F.

Class.	Sales Profit Unit.	Factory Charges Unit.
A.	1·112	·212
B.	·854	·162
C.	·649	·132
D.	476	·126
E.	·234	·081
F.	·219	·066

If we now take the output as given in Table D, we find that

Class A.	292 × ·212	=	61·904
,, B.	345 × ·162	=	55·890
,, C.	224 × ·132	=	29·568
,, D.	425 × ·126	=	53·610
,, E.	445 × ·081	=	36·045
,, F.	533 × ·066	=	35·178
	2,164		272·195

Taking our estimated basis of 70 units per week, we have a total of factory charges units to provide of 1,050 units at ·260=279 units of factory charges, as against only 272·195 actually provided for by the output, and which yet provides profit units satisfactory to the Sales Department.

Diagram No. 3.

Comparison of Sale Profit Units and Factory Expenses Units provided by the following Machines.

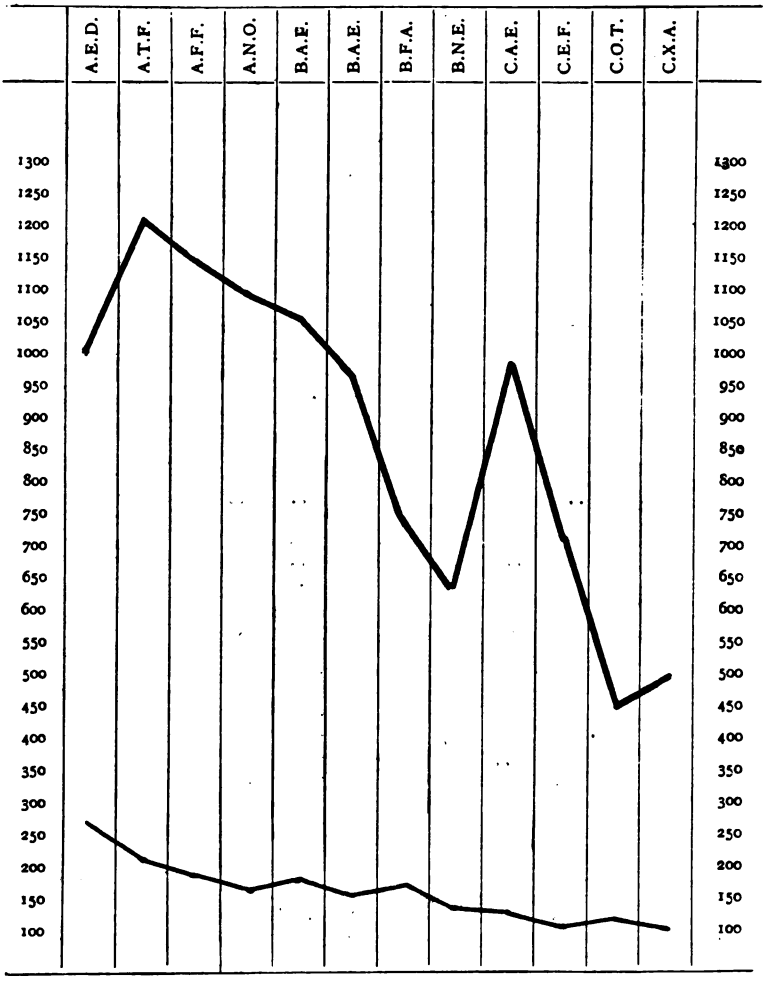


Diagram No. 4.—

Showing the proportion of Output of each Machine required to make the Average Output required for both Factory Charges and Sales Margins.

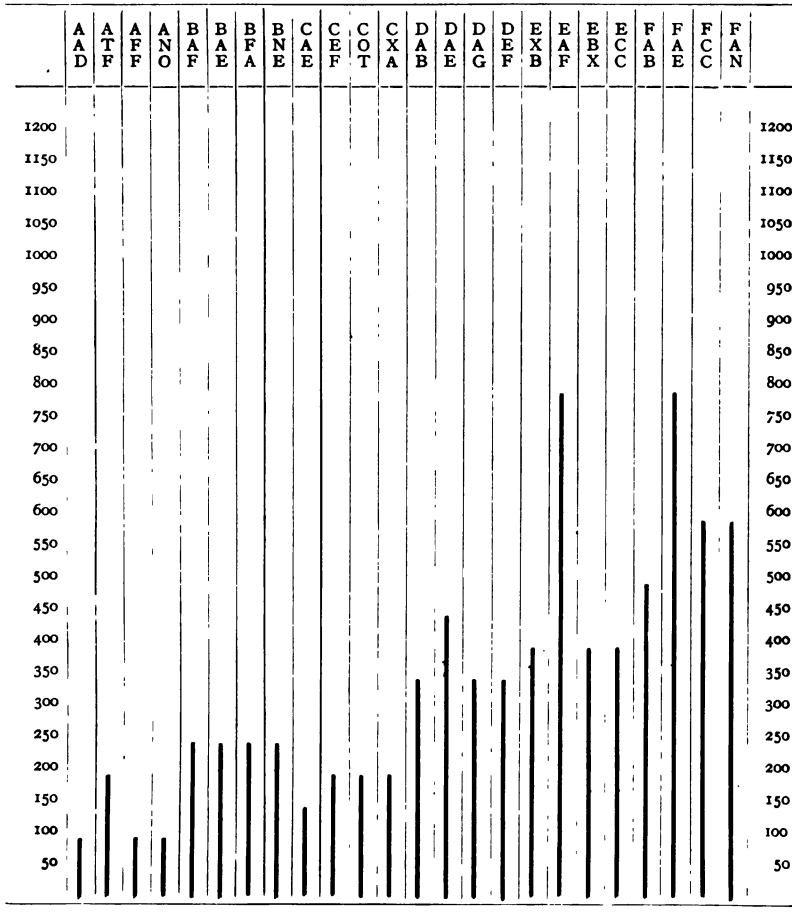
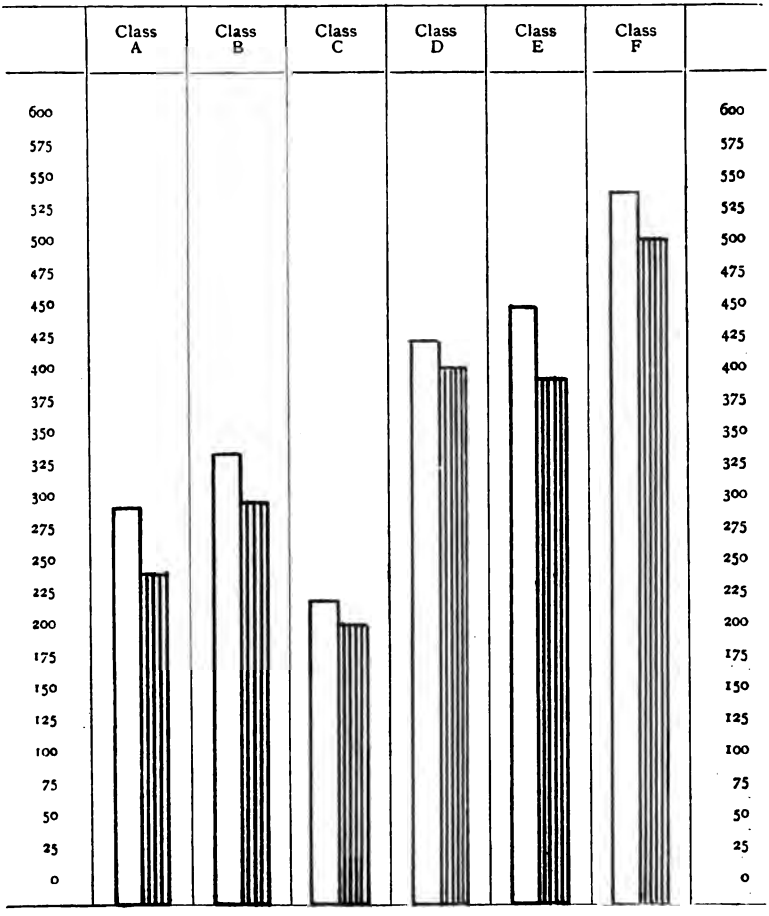


Diagram No. 5.

SHOWING SALES OUTPUT IN MACHINE CLASSES (TABLE D).



The shaded block shows the value of the sales as against the actual quantity sales in the open block, and shows the relative reductions on the unit figures for comparison. See Table D.

CHAPTER XIII.

CONCLUSION.

A brief recapitulation of the points dealt with may now be of service in enabling the reader to obtain a bird's-eye view of the system as set out in the preceding chapters, and at the same time to enable him, comprehensively, to grasp the methods advocated.

In the *first* place, the elements of prime cost as purchases and wages are carried forward to the Final Summary, and instead of the results being obscured by their entering into the maze of detail generally met with, they are by the interposition of the unit, brought into direct focus in the Final Periodical Statement, and the efficiency of the factory management thereby demonstrated.

In the *second* place, the position of the factory production in cases of seasonal preparation is effectively demonstrated in the Weekly Returns as readily as if the actual output in completed machines had materialised.

The writer, some years ago, was called upon to furnish, for the information of the Board of Directors, a comparative report on the position of the various works of the company in their preparation for the output of the coming season.

The question at issue was whether, in view of the purchases made and wages expended, the production of parts of machines

was commensurate, and might be expected when the time for output arrived to provide for the factory expenses incurred.

The information available was the usual Trading Account, particulars of Purchases, Wages, and Expenses; but there existed no method of measurement of the actual production, and, owing to the number and variety of the parts and the number of machines, it was impossible, without the usual stocktaking, to show the production of the factories.

Even to-day, if we take some of our best equipped and most modern cycle works, a similar demand would find them totally unprepared to answer the question, notwithstanding the expenditure in clerical labour provided.

The tendency to specialisation in operating, by which alone it is possible to economise in cost of production, necessarily involves a mass of details which it would be impossible to cope with by any practicable expenditure on clerical labour. A very little consideration will show that, with the most extensive system of cards, the bringing together of the information into some effective periodical return at short intervals involves in sterling so many calculations as to make the same impracticable.

It is only possible by the adoption of some common standard, into which quantity and value will be convertible in set terms, to obtain a measurement of work in progress and stocks, and by no other known method can a great variety of parts, finished and unfinished machines, be expressed in value in productive output.

It is possible in the case of a contract to take the tender on the one hand, and by a careful analysis of the expenditure, and systematic allocation, to show the result of the transaction in its entirety. It has been laid down by *The*

Accountant that every system of Cost Accounts should show the variation of results from the estimates of cost. While this is possible in the case of contracts, or what are referred to in the General Preface as "Terminal Costs," it is not so much the allocation of material and wages—each of which, with more or less difficulty, may be analysed and dissected—but the allocation of fixed charges, which is the factor of unknown quantity.

It is the special claim of the Unit System to provide a satisfactory method for this allocation, which, notwithstanding violent fluctuations in the character of the output, will give approximately accurate results at the close of the financial period.

The provision of periodical returns with a minimum of clerical labour, and in a comparatively small focus, for the purposes of the management, and which shall provide not only history, but a basis for operating, is, in the case of the complex industries classified under this section, a problem which has engaged considerable attention and endeavour, without up to the present eliciting any published methods of practical interest.

The presentment of such a system as the "Unit Method of Cost" within the limits of a volume of "The Accountants' Library" necessarily involves considerable compression, and the number of examples could be indefinitely multiplied.

It is often a matter of complaint that the working out of cost methods is avoided in detail, and that there is a want of cumulative examples in the illustrations given.

The method of presentment adopted has been designed to provide the reader, in the first place, with a general view of the operations of the business selected by commencing with the Balance Sheet, Trading Account, and Manufacturing Account,

and to proceed from them to the cost details. This is a reversal of the usual methods, but, in the opinion of the writer, is to be preferred.

It has not been deemed necessary to include in the text the working of the Nominal or Impersonal Ledger, or of the Cost Ledgers, as the reader is assumed to have passed the bookkeeping stage, and examples of Ledger rulings form no part of the treatise. It is not the complexity of the Unit system, but the unconventional simplicity of its methods, which is likely to give trouble to the reader. It may be added, however, that some of the Ledger rulings, which include provision for metric summation in columns, as published by leading firms, are particularly adapted for the Works Office books, and render the additions much easier.

The system of unit measurement, in the case of large combinations of works, has been carried into the Capital Accounts, and the proportions of the stock and book debts to turnover in the presentment of the Capital Accounts unitised with considerable advantage in comparisons.

The development of the Unit Method will unquestionably receive considerable impetus should the agitation for a metric system crystallise into practicable form; and, whatever opinions may be held as to the practicability of its adoption in commerce, there can be no question but that its adoption in the internal organisation of the Factory Cost Accounts affords considerable advantages over the ordinary bookkeeping in sterling values.

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